3.2 WATER QUALITY

3.2.1 Introduction

This section presents the existing environment and impacts analysis of water quality issues associated with the granting of a new lease to Shore Terminals, LLC to continue to operate its marine terminal in southwestern Suisun Bay. Section 3.2.2 describes the existing conditions and the regulatory framework on a federal, state, and local level. Section 3.2.2 provides information on existing water and sediment quality in the San Francisco Bay Estuary and, in more detail, for the project area (Suisun Bay and Carquinez Strait) as well as the immediate vicinity of the Shore facility.

Section 3.2.3 presents the impact analysis. Water quality issues associated with renewing Shore Terminals lease include the chronic water quality impacts of continuing operations and those related to a crude oil or product spill. Operational impacts to water quality could come from the release of segregated ballast water, runoff of contaminants on the pier, the leaching of contaminants from antifouling paints or sacrificial anodes from ships visiting the terminal, the resuspension of sediments by ship propellers and bow thrusters or by maintenance dredging, and the disposal of dredged sediments. A spill of crude oil or product could have wide ranging effects on water quality in San Francisco Bay.

3.2.2 Existing Conditions

3.2.2.1 Regulatory Framework

The regulatory framework includes laws, regulations, plans, polices, and programs at the federal, State, local, and regional levels. Specific laws and regulations are referenced later in the text, and provide the underlying basis for plans, policies, and programs.

Federal Policies

The Federal Clean Water Act (CWA) (35 U.S.C. 1251 et. seq.) delegates certain responsibilities in water quality control and water quality planning to the states. In California, the California Environmental Protection Agency (Cal EPA) and the State Water Resources Control Board (SWRCB) agreed to such delegation and regional boards implement portions of the CWA, such as the issuance of National Pollution Discharge Elimination System (NPDES) permits. The aim of the CWA of 1977 (33 U.S.C. 1251 et seq.) is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. Specific sections control the discharge of wastes into marine and aquatic environments. CWA Section 402 states that discharge of pollutants to waters of the United States is unlawful unless the discharge is in compliance with an NPDES permit. CWA Section 404 establishes a permit program to regulate the filling of jurisdictional waters including the discharge of dredged material into waters of the United States. The U.S. Army Corps of Engineers (Corps) has jurisdictional authority pursuant to CWA Section 404. The EPA assists the Corps in evaluating environmental impacts of dredging and filling, including water quality and historic and biological values. CWA Section 401 requires that activities permitted under Section 404 must not cause concentrations of chemicals in the water column to exceed state standards. CWA Section 303(d) requires that states develop a list of waterbodies that need additional work beyond existing controls to achieve or maintain water quality standards. The additional work includes the establishment of total maximum daily loads (TMDLs) of pollutants that have impaired the waterbody.

The National Estuary Program was established in 1987 by amendments to the CWA to identify, restore, and protect nationally significant estuaries of the United States. The San Francisco Estuary Project is one of over 20 Estuary Projects established by the National Estuary Program. The San Francisco Estuary Project is a cooperative federal, state, and local program to promote effective management of the San Francisco Bay-Delta Estuary.

The Coastal Zone Management Act of 1972 (16 U.S.C. 1455 et. seq.) regulates development and use of the nation's coastal zone by encouraging states to develop and implement coastal zone management programs. Section 6217 of the Coastal Zone Act Reauthorization Amendments of 1990 (CZARA) (16 U.S.C. 1455b) required the coastal states with federally approved coastal zone management plans to develop and submit coastal nonpoint source pollution control programs for approval by the National Oceanic and Atmospheric Administration (NOAA) and the Environmental Protection Agency (EPA). Long-range planning and management of California's coastal zone were conferred to the state with implementation of the California Coastal Act of 1976.

State Plans and Policies

The quality of California's coastal environment is protected under the California Coastal Act, which established the California Coastal Commission (CCC). Several provisions of the California Coastal Act serve to protect coastal water quality from point and nonpoint source pollution. The McAteer-Petris Act governs planning and management of the San Francisco Bay portion of the California Coastal Management Program. The McAteer-Petris Act established the San Francisco Bay Conservation and Development Commission (BCDC) as the agency responsible for protection of San Francisco Bay that includes critical and sensitive Bay areas. Sensitive areas near the Proposed Project are identified in Section 3.2.2.3.

The California Porter-Cologne Water Quality Control Act of 1969 established the SWRCB and nine Regional Water Quality Control Boards (RWQCB) as the principal state agencies with primary responsibility for the coordination and control of water quality. The SWRCB is generally responsible for setting statewide water quality policy. Each RWQCB makes water quality and regulatory decisions for its region. In 1991, the SWRCB and RWQCBs were brought together with five other State environmental protection agencies under the newly crafted California Environmental Protection Agency. Measures to protect and restore the quality of California's coastal water also are addressed in the state's Plan for California's Nonpoint Source Pollution Control Program, which the state prepared pursuant to both the CWA and the CZARA.

The Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan) (RWQCB 1995) is the primary policy document that guides the RWQCB, San Francisco Bay Region. Established under the requirements of the 1969 Porter-Cologne Water Quality Control Act, the Basin Plan was originally adopted in April 1975, and the most recent revisions were adopted in 1995 and approved by the EPA in 2000. Recent proposed amendments to the Basin Plan include adoption of California Toxic Rule water quality criteria and definitions in lieu of Basin Plan water quality objectives, update of Basin Plan provisions relating to implementation of water quality standards, and several non-regulatory updates. A Public Hearing related to these proposed amendments was scheduled for January 21, 2004. The Basin Plan applies to point and nonpoint sources of waste discharge to the Bay, but not to vessel wastes or the control of dredge material disposal or discharge. The Basin Plan assigns beneficial uses to all waters in the basin. These beneficial uses include municipal, industrial, and agricultural water supply; freshwater replenishment and groundwater recharge; water contact and noncontact recreation; navigation; commercial and sportfishing; shellfish harvesting; marine, estuary, wildlife, and warm and cold freshwater habitat; preservation and enhancement of Areas of Biological Significance; and rare and endangered species, wildlife, fish migration, and fish spawning. The Basin Plan also sets water quality objectives, subject to approval by the EPA, intended to protect designated beneficial uses. The water quality objectives in the Basin Plan are written to apply to specific parameters (numeric objectives) and general characteristics of the water body (narrative objectives). The water quality objectives are achieved primarily through effluent limitations embodied in the NPDES program.

The San Francisco Bay Region RWQCB has NPDES permit authority on any facility or activity that discharges waste into the Bay. Effluent limits are contained within the NPDES permit; the discharge of process wastewater containing constituents in excess of the limits stated within the NPDES permit is prohibited.

The California State Lands Commission (CSLC) issues dredging permits for projects that propose to dredge in state-owned submerged lands, tidelands, and marshes. In addition, any project sponsor seeking to use state-owned lands for right-of-way uses must obtain a land use lease from the CSLC. For each of these discretionary decisions, the CSLC bases its decision on information presented in environmental documentation prepared pursuant to the requirements of the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA).

Local and Regional Plans and Water Quality Policies and Programs

The BCDC's San Francisco Bay Plan, adopted in 1968, provides policies to guide future uses of the Bay and shoreline. BCDC regulates all Bay dredging and filling to protect marshes, wetlands, and other resources of the Bay. Its jurisdiction includes all areas of the Bay below the line of highest tidal action as well as 100 feet inland from the line of highest tidal action. The San Francisco Bay Plan designates the area in the vicinity of the Shore marine terminal along the southern shore of Carquinez Strait/Suisun Bay between the Martinez-Benicia Bridge and Pacheco Creek for tidal marsh and Water-Related Industry. The Plan specifies that in this area "pipelines and piers may be built over marshes." Policies within the Plan indicate that "pipeline terminal and distribution facilities near the Bay should generally be located in industrial areas" and that "marine terminals should also be shared as much as possible among industries and port uses."

The Long-Term Management Strategy (LTMS) for Placement of Dredged Materials in the San Francisco Bay region is a cooperative effort of the EPA, the Corps, SWRCB, the RWQCB, and the BCDC to develop a new approach to dredging and dredged material disposal in the San Francisco Bay area. The major goals of the LTMS are to:

1. maintain, in an economically and environmentally sound manner, those channels necessary for navigation in the San Francisco Bay and Estuary while eliminating unnecessary dredging activities;
2. conduct dredged material disposal in the most environmentally sound manner;
3. maximize the re-use of dredged material as a resource; and
4. establish a cooperative permitting framework for dredging and disposal of dredged materials.

The LTMS agencies completed a Final Policy Environmental Impact Statement (EIS)/Programmatic Environmental Impact Report (EIR) (October 1998), proposing the new long-term plan for achieving these goals. The new approach calls for reducing disposal within San Francisco Bay over time, and increasing recycling of dredged material for "beneficial uses," including habitat restoration, levee maintenance, and construction fill. The LTMS agencies have also established an interagency Dredged Material Management Office (DMMO), which serves as a "one stop shop" for Bay Area dredging permit applications. The planning process for LTMS implementation is continuing.

The CALFED Bay-Delta Program was formed to resolve conflicts over freshwater uses in the Bay Delta. The mission of the CALFED Bay-Delta Program is to develop a long-term comprehensive plan that will restore ecological health and improve water management for beneficial uses of the Bay-Delta System. State-federal cooperation was formalized in June 1994 with the signing of a Framework Agreement by the state and federal agencies with management and regulatory responsibility in the Bay-Delta Estuary. The CALFED agencies are:

State: Resources Agency, Department of Water Resources, California Department of Fish and Game (CDFG), Cal EPA, SWRCB, and CSLC.

Federal: Bureau of Reclamation, U.S. Fish and Wildlife Service (USFWS), EPA, Department of Commerce, NOAA Fisheries, the Corps, Department of Agriculture, and Natural Resources Conservation Service.

These agencies provide policy direction and oversight for the process.

The Framework Agreement pledged that the state and federal agencies would work together in three aspects of Bay-Delta management: (1) water quality standards formulation, (2) coordination of State Water Project and Central Valley Project operations with regulatory requirements, and (3) long-term solutions to problems in the Bay-Delta Estuary.

Objectives and Criteria

To protect beneficial uses, the RWQCB has established objectives for waters covered by the San Francisco Basin Plan. Table 3.2-1 lists the narrative objectives for San Francisco Bay waters. Table 3.2-2 lists the numerical objectives for chemical constituents for San Francisco Bay waters with a salinity greater than 5 parts per thousand (ppt).

Water quality criteria (WQC) for priority toxic pollutants for California inland surface waters, enclosed bays, and estuaries were established by the California Toxics Rule (USEPA 2000). Table 3.2-3 shows the California Toxic Rule criteria. The proposed amendments to the Basin Plan would replace the Basin Plan numerical objectives (shown in Table 3.2-2) with the California Toxics Rule criteria (Table 3.2-3).

At this time, no standards for the protection of aquatic organisms for chemical levels in sediments have been set. NOAA has published effects-based sediment quality values for evaluating the potential for contaminants in sediment to cause adverse biological effects (Long and Morgan 1990, Long et al. 1995). These values are commonly used as guidelines to evaluate sediment contaminant concentrations. These values are referred to as Effects Range-Low (ER-L) and Effects Range-Medium (ER-M) (Long and Morgan 1990, Long et al. 1995). This tool for comparing sediment quality was developed for NOAA based on tests of toxicity of sediments to benthic organisms. In these tests, effects were rarely seen below the ER-L. Therefore, at chemical concentrations below the ER-L, effects are unlikely. Effects were usually seen above the ER-M. Thus, the ER-M is considered the concentration at which effects are probable. Table 3.2-4 shows these sediment criteria.

Finally, as a way of evaluating sediment contamination within San Francisco Bay, the San Francisco Estuary Institute has compiled thresholds of ambient sediment concentrations based on the cleanest portions of San Francisco Bay (Gandesbery et al. 1999). These thresholds, shown in Table 3.2-5, recognize that no part of San Francisco Bay is free of anthropogenic inputs of contaminants, but these thresholds provide a relative measure of comparing sediment contaminant concentrations within the Bay. As shown in Table 3.2-5 even ambient metal concentrations in different size particles of sediment in San Francisco Bay exceed the ER-L concentration for arsenic, chromium, mercury, and total DDT. Sediments with greater than 40 percent fines content also exceed the ER-L for copper, acenaphthylene, anthracene, fluorene, and high molecular weight PAHs. Both fine and coarser sediments exceed the ER-M for nickel.

Table 3.2-1
Select Water Quality Objectives from the San Francisco Bay Basin Plan

Parameter	Objective
Bioaccumulation	Controllable water quality factors shall not cause a detrimental increase in concentrations of toxic substances found in bottom sediments or aquatic life.
Biostimulatory Substances	Waters shall not contain biostimulatory substances in concentrations that promote aquatic growth to the extent that such growths cause nuisance or adversely affect beneficial uses.
Color	Waters shall be free of coloration that causes nuisance or adversely affects beneficial uses.
Dissolved Oxygen (Do)	For all tidal waters, the following objectives shall apply: in the bay, downstream of Carquinez bridge 5.0 mg/l minimum, upstream of Carquinez bridge 7.0 mg/l minimum.
Floating Material	Waters shall not contain floating material, including solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect beneficial uses.
Oil and Grease	Waters shall not contain oils, greases, waxes, or other materials in concentrations that result in a visible film or coating on the surface of the water or on objects in the water, that cause nuisance, or that otherwise adversely affect beneficial uses.
Population and Community Ecology	All waters shall be maintained free of toxic substances in concentrations that are lethal to or that produce significant alteration in population, community ecology or receiving water biota.
pH	The pH shall not be depressed below 6.5 nor raised above 8.5.
Salinity	Controllable water quality factors shall not increase the total dissolved solids or salinity of waters of the state so as to adversely affect beneficial uses, particularly fish migration and estuarine habitat.
Sediment	The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses. Controllable water quality factors shall not cause a detrimental increase in the concentrations of toxic pollutants in sediments or aquatic life.
Settleable Material	Waters shall not contain substances in concentrations that result in the deposition of material that cause nuisance or adversely affect beneficial uses.
Sulfide	All water shall be free from dissolved sulfide concentrations above natural background levels.
Suspended Material	Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.
Taste and Odor	Waters shall not contain taste- or odor-producing substances in concentrations that impart undesirable tastes or odors to fish flesh or other edible products of aquatic origin, that cause nuisance, or that adversely affect beneficial uses.
Temperature	Temperature objectives for enclosed bays and estuaries are as specified in the “Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays of California,” any aquatic habitat shall not be increased by more than 5º F above natural temperatures.
Toxicity	All waters shall be maintained free of toxic substances in concentrations that are lethal to or that produce other detrimental responses in aquatic organisms.
Turbidity	Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases from normal background light penetration or turbidity relatable to waste discharge shall not be greater than 10 percent in areas where natural turbidity is greater than 50 ntu.
Un-Ionized Ammonia	The discharge of wastes shall not cause receiving waters to contain concentrations of un-ionized ammonia in excess of the following limits: annual median 0.025 mg/l, maximum (central bay and upstream) 0.16 mg/l.

Source: RWQCB (1995). Water Quality Control Plan San Francisco Bay Basin (Region 2).

Table 3.2-2
San Francisco Basin Plan
Water Quality Objectives for Toxic Pollutants for
Surface Waters with Salinities Greater than 5 PPT+

Compound	4-Day Average	1-Hr Average	24-Hr Average	Instantaneous Maximum
Arsenic	36.0	69.0		
Cadmium	9.3	43.0		
Chromium (VI)	50.0	1,100.0		
Copper		4.9*		
Cyanide		5.0		
Lead	5.6	140.0		
Mercury	0.025	2.1		
Nickel			7.1	140.0
Silver				2.3
Zinc			58.0	170.0
PAHs			15.0	

Source: RWQCB 1995. Water Quality Control Plan San Francisco Bay Basin (Region 2).
All values in UG/L.
***Under review by EPA.**
+The proposed amendments to the Basin Plan would replace these numerical objectives with the California Toxics Rule Concentrations (See Table 3.2-3)

Table 3.2-3
California Toxics Rule Toxic Materials Concentrations for Saltwater

Constituent	Criterion Maximum Concentration (ug/L)	Criterion Continuous Concentration (ug/L)
Arsenic	69	36
Cadmium	42	9.3
Chromium (VI)	1100	50
Copper	4.8	3.1
Lead	210	8.1
Mercury*	2.1	0.025
Nickel	74	8.2
Selenium	290	71
Silver	1.9	
Zinc	90	81
Cyanide	1	1
Pentachlorophenol	13	7.9
Aldrin	1.3	
gamma-BHC	0.16	
Chlordane	0.09	0.004
4,4'-DDT	0.13	0.001
Dieldrin	0.71	0.0019
alpha-Endosulfan	0.034	0.0087
beta-Endosulfan	0.034	0.0087
Endrin	0.037	0.0023
Heptachlor	0.053	0.0036
Heptachlor Epoxide	0.053	0.0036
PCB-1242		0.03
PCB-1254		0.03
PCB-1221		0.03
PCB-1232		0.03
PCB-1248		0.03
PCB-1260		0.03
PCB-1016		0.03
Toxaphene	0.21	0.0002

pg/L = Micrograms per liter.
*** = National Toxics Rule 1997, not yet established by California Toxics Rule**
Source: USEPA 2000

Table 3.2-4
Sediment Effects Guideline Values

Parameter	Effects Range-Low (ER-L)	Effects Range-Median (ER-M)
Metals (mg/Kg)		
Antimony	2.0	2.5
Arsenic	8.2	70
Cadmium	1.2	9.6
Chromium	81	370
Copper	34	270
Lead	46.7	218
Mercury	0.15	0.71
Nickel	20.9	51.6
Silver	1	3.7
Zinc	150	410
Organics (pg/Kg)		
Acenaphthene	16	500
Acenaphthylene	44	640
Anthracene	85.3	1100
Fluorene	19	540
2-Methyl naphthalene	70	670
Naphthalene	160	2100
Phenanthrene	240	1500
Low-molecular weight PAH	552	3160
Benz(a)anthracene	261	1600
Benzo(a)pyrene	430	1600
Chrysene	384	2800
Dibenzo(a,h)anthracene	63.4	260
Fluoranthene	600	5100
Pyrene	665	2600
High molecular weight PAH	1700	9600
Total PAH	4022	44792
p,p'-DDE	2.2	27
Total DDT	1.58	46.1
Total PCBs	22.7	180

ER-L = Concentration at lower tenth percentile at which adverse biological effects were observed or predicted.
ER-M = Concentration at which adverse biological effects were observed or predicted in 50% of test organisms.
mg/Kg – milligrams per kilogram.
pg/Kg – micrograms per kilogram
Source: Long et al. 1995.

Table 3.2-5
Sediment Thresholds for San Francisco Bay

Analyte	SF Estuary Sediment Ambient Concentration (dry wt.) [p=.85]		ERL[1] (dry wt.)	ERM[2] (dry wt.)
	<40 % fines	40-100 % fines		
Metals (ppm) (HNO3/HCl Digestion)				
Arsenic	13.5	15.3	8.2[1]	70[2]
Cadmium	0.25	0.33	1.2	9.60
Chromium	91.4	112	81	370
Copper	31.7	68.1	34	270
Lead	20.3	43.2	46.7	218
Mercury	0.25	0.43	0.15	0.71
Nickel	92.9	112	20.9	51.6
Selenium	0.59	0.64		
Silver	0.31	0.58	1	3.7
Zinc	97.8	158	150	410
Organic Compounds (ppb)				
Chlordanes, total	0.42	1.1		
Dieldrin	0.18	0.44		
HCH, total	0.31	0.78		
HCB, total	0.19	0.48		
DDTs, total 6 isomers	2.8	7	1.58	46.1
PCBs, total	5.9	14.8	22.7	180
PCBs, total (SFEI 40 list)	8.6	21.6		
1-Methylnaphthalene	6.8	12.1		
1-Methylphenanthrene	4.5	31.7		
2,3,5-Trimethylnaphthalene	3.3	9.8		
2,6-Dimethylnaphthalene	5	12.1		
2-Methylnaphthalene	9.4	19.4	70	670
Acenaphthene	11.3	26.6	16	500
Acenaphthylene	2.2	31.7	44	640
Anthracene	9.3	88	85.3	1,100
Benz(a)anthracene	15.9	244	261	1,600
Benzo(a)pyrene	18.1	412	430	1,600
Benzo(b)fluoranthene	32.1	371		
Benzo(e)pyrene	17.3	294		
Benzo(g,h,i)perylebe	22.9	310		
Benzo(k)fluoranthene	29.2	258		
Biphenyl	6.5	12.9		
Chrysene	19.4	289	384	2,800
Dibenz(a,h)anthracene	3	32.7	63.4	260
Fluoranthene	78.7	514	600	5,100
Fluorene	4	25.3	19	540
Indeno(1,2,3-c,d)pyrene	19	382		
Naphthalene	8.8	55.8	160	2,100
Perylene	24	145		
Phenanthrene	17.8	237	240	1,500
Pyrene	64.6	665	665	2,600
High molecular weight PAHs, total	256	3,060	1,700	9,600
Low molecular weight PAHs, total	37.9	434	552	3,160
PAHs, total	211	3,390	4,022	44,792

Source: Gandesbery et al. 1999.
[1] ER-L = Effects Range Low.
[2] ER-M = Effects Range Median.

3.2.2.2 San Francisco Bay/Estuary Regional Setting

Introduction

San Francisco Bay/Estuary is the largest estuary on the West Coast of the contiguous United States and covers an area of 1,166 square kilometers (450 square miles). The majority of San Francisco Bay is roughly parallel to the coastline in a north to south orientation (Figure 3.2-1), about 5 miles inland from the coastline. Several bridges span the Bay connecting the urban areas along the edges of the Bay. These bridges also serve as dividing lines for subregions of San Francisco Bay. South San Francisco Bay is the large area south of the Bay Bridge, while the Central Bay is a relatively smaller area between the Bay Bridge and Richmond-San Rafael Bridge. San Francisco Bay's connection to the Pacific Ocean is a small opening in the land mass at the Golden Gate. San Pablo Bay is a large area north of the Richmond-San Rafael Bridge. From San Pablo Bay, the San Francisco Bay/Estuary extends eastward through the Carquinez Strait and Suisun Bay, to the Delta of the Sacramento and San Joaquin Rivers. Central Bay is strongly influenced by the ocean, South Bay is a semi-enclosed embayment with numerous small, local freshwater inflows, and San Pablo Bay and Suisun Bay are strongly influenced by freshwater flows from the Sacramento and San Joaquin Rivers, through the Delta, which drains about 40 percent of California (Thompson et al. 2000).

San Francisco Bay is a highly industrialized and urbanized estuary with a long history of human impacts. Many contaminants in the water, sediments, and biota in various parts of the estuary have been detected at concentrations exceeding guidelines. The various embayments of San Francisco Estuary have been listed as impaired pursuant to Section 303(d) of the CWA.

Water quality of San Francisco Bay and Estuary (Bay) is affected by many factors, including:

- geographic configuration of the Bay,
- tidal exchange with the ocean,
- freshwater inflows,
- industrial and municipal wastewater discharges,
- dredging and dredge material disposal,
- runoff from highly urbanized areas adjacent to the Bay,
- agricultural and pasture land drainage from much of central California,
- marine vessel discharges,
- historic mining activities,
- leaks and spills, and
- atmospheric deposition.

Figure 3.2-1 Depth Contours for San Francisco and San Pablo Bays and Carquinez Straits

Bathymetry, tidal flows, and circulation of San Francisco Bay are discussed below in the physical processes section. In the following section, the various sources of contaminants are identified. Finally, general information on contaminant levels in the water and sediments of the bay is presented.

Physical Processes

San Francisco Bay has complex bottom topography with broad shallow embayments that are incised by a deeper channel, channel constrictions between the embayments, and connection to the Pacific Ocean through a deep narrow entrance at the Golden Gate. Depth contours for San Francisco Bay are shown on Figure 3.2-1. Water depths in San Francisco Bay range from zero to greater than 100 meters (m) at the entrance to the Bay at the Golden Gate. The deeper portions of the Bay are along the west side of Central Bay. The strong tidal currents in Central Bay result in significant sand waves along the bottom that have heights of 7 to 10 feet.

Much of the Bay is relatively shallow. Approximately half the surface area of the Bay has water depths less than 2 m (7 ft) below MLLW when intertidal mudflats are included in the definition of the surface area (Conomos et al. 1985). The 10-m-depth (33-feet) contour extends about a third of the way into South San Francisco Bay. Dredging of a narrow channel has extended this contour through South San Francisco Bay. The 10-m-depth contour extends northward to Carquinez Strait in a fairly narrow shipping channel. Depth contours in San Francisco Bay/Estuary are very important because they direct the strong tidal flow in the Bay.

Water quality of San Francisco Bay is greatly affected by tidal exchange with the Pacific Ocean through the Golden Gate. The average tide range for the San Francisco Bay Area is about 5 feet of elevation change. With the large surface area of San Francisco Bay, this results in extremely large volumes (50×10^9 cubic feet, or 1 million acre feet) of water flowing into and out of the Bay every 6 hours with the change of tides. The bottom contours of the Bay direct the flow of the flooding tide into North and South San Francisco Bay. Large eddies are created in Central San Francisco Bay by the tidal exchange. Waters from the Pacific Ocean are generally saltier and cooler than the waters in San Francisco Bay, and thus the tidal exchange is generally in the deeper waters of the Bay.

San Francisco Bay (especially the Northern Reach of San Pablo Bay, Carquinez Strait, Suisun Bay and the Delta) is strongly influenced by freshwater flows. The Sacramento and San Joaquin Rivers are the largest sources of fresh water, contributing on average 19.3 and 3.4 million-acre-feet per year, respectively. The volume and timing of these freshwater inflows vary dramatically from year to year depending on the amount of rain and snowfall. The highest inflows usually occur between November and May. This fresh water is generally warmer than the ocean water, and with its low salinity, is less dense than seawater. Summers are generally dry with little rain or runoff.

Circulation and mixing are relatively complicated in San Francisco Bay because of the complex geometry and variable amount of freshwater flow during the year. The circulation of water in the Bay is driven primarily by tides, and to some extent, by wind-induced currents and estuarine circulation.

Tides are responsible for most of the water motion in the Bay. They are the dominant force for mixing and contribute greatly to the dispersion of material. However, tidal motion is oscillatory and consequently contributes proportionally little to the net transport of material out of the Bay (Davis 1982). Net transport out of the Bay is equivalent to freshwater flows into the Bay (including publicly owned treatment works [POTW] and industrial discharges) and the amount of new ocean water introduced by tides. Freshwater flows into the Bay from the Delta result in estuarine circulation that is driven by the density difference between freshwater and saline ocean water. These flows vary greatly with location in the Bay and the amount of freshwater input. Vertical stratification of water quality parameters in the Bay also varies substantially depending on the location and the amount of the freshwater flows.

During the winter, the water residence time is approximately 2 weeks for the northern reaches of the Bay, while in southern portions of the Bay residence times are approximately 2 months. During the summer, water residence time is 2 months for the northern reaches of the Bay, while in the southern portions of the Bay, residence times are 5 months (Conomos 1979).

Wind mixing, like tidal mixing, contributes greatly to local mixing, but contributes very little to net flow of fluids, sediments, and pollutants out of the Bay.

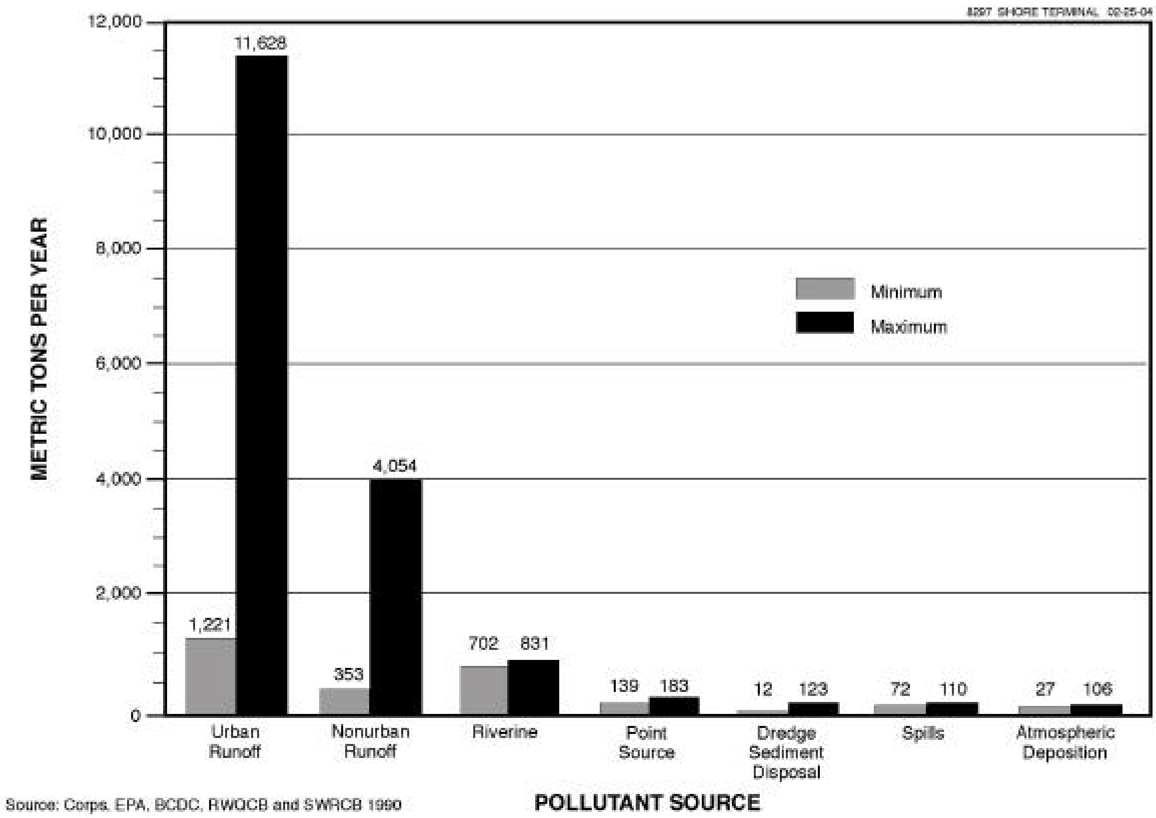
<u>Sources of Pollutants to San Francisco Bay/Estuary</u>

Figure 3.2-2 compares the magnitude of pollutant loadings to San Francisco Bay from various sources. The largest sources of pollutant input to the Bay are nonpoint discharges including urban and non-urban runoff and inputs from rivers.

Urban runoff is the water from urban areas that flows into the Estuary in streams and storm drains. It includes rainwater, excess irrigation flows, and water used for washing down sidewalks and parking lots.

Sources of pollutants in urban runoff are extremely varied and include commercial, industrial, and residential land uses, as well as pollutants from managed open space areas such as parks, cemeteries, planted road dividers, and construction sites. Human activities in these areas, such as the application of pesticides and fertilizers to gardens and landscaping, operation of motor vehicles, and construction of roads and buildings, all contribute pollutants to urban runoff.

A recent study of contaminant loads from stormwater to the San Francisco Bay region indicated that residential areas appeared to be a large contributor to all of the metals (Davis et al. 2000). Commercial and industrial areas generate substantial loads of phosphate, cadmium, lead, zinc, and other contaminants.



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COMBINED POLLUTANT LOADINGS TO THE BAY/DELTA BY SOURCE TYPE
Figure 3.2-2

Non-urban sources of nonpoint pollution include runoff agricultural lands, forests, pastures, and natural range, and are contributed to the Bay by rainfall runoff, excess irrigation return flows, and subsurface agricultural drainage. Pollutants of concern in non-urban runoff include trace elements, synthetic organic pollutants (particularly pesticides), and solvents used for pesticide application.

The Sacramento and San Joaquin Rivers are the major rivers that discharge into San Francisco Bay. These rivers receive drainage from almost 40 percent of the land area of California and drain California's major agricultural region, the Central Valley. Contaminant loading from rivers is considered to be significant for mercury, selenium, nickel, silver, and registered pesticides and possibly may be significant for PCBs, PAHs, copper, and cadmium (Davis et al. 2000).

San Francisco Bay/Estuary receives inputs from industrial and municipal discharges. The Bay receives treated wastewater from several municipal discharges that serve the large metropolitan areas surrounding the Bay. Municipal discharges are the largest point source discharges to San Francisco Bay. Permitted dry weather flow is 565 mgd for municipal discharges to San Francisco Bay (RWQCB 1995). The average dry weather flow is less than this maximum permitted amount. The largest municipal discharger is the San Jose/Santa Clara Water Treatment Plant with an average daily discharge volume of about 133 mgd (Davis et al. 2000). The major industrial dischargers are oil refineries such as the Chevron Richmond refinery in Central Bay. Effluent discharges are considered currently to be a significant pathway for two high priority contaminants, selenium and organophosphate pesticides (Davis et al. 2000).

Every year, an average of 6 million cubic yards (mcy) of sediments must be dredged from shipping channels and related navigation facilities throughout San Francisco Bay. In the past, the majority (80 percent) of dredged material was disposed at designated sites in the Bay. Today, three in-Bay disposal sites are designated for multiple users: the Carquinez Strait, San Pablo Bay, and Alcatraz Island disposal sites. The Alcatraz site is the most heavily used of the in-Bay sites, receiving up to 4 mcy of sediment per year from Central and South Bay dredging projects. Another 1 to 2 mcy of dredged material per year is disposed at the Carquinez Strait site, and up to 0.5 mcy at the San Pablo Bay site. Two additional aquatic disposal sites, the Suisun Bay site and the San Francisco Bar Channel site just outside the Golden Gate, are restricted to disposal of clean sand from Corps maintenance dredging projects. The LTMS for Placement of Dredged Material in the San Francisco Bay Region calls for a balanced upland/wetland reuse and ocean disposal (Corps et al. 1998). This preferred alternative includes low in-Bay disposal (approximately 20 percent compared to the present 80 percent), medium ocean disposal (approximately 40 percent), and medium upland/wetland reuse (approximately 40 percent). Dredged material disposal is considered to be a minor pathway for the loading of contaminants to San Francisco Bay (Davis et al. 2000). Copper is the only contaminant where this pathway may be significant.

Marine vessels are also sources of various pollutants to the estuary. The discharge of untreated sewage and gray water from commercial and recreational vessels has caused concern in various parts of the estuary. Vessel discharges, including release of bilge waters, are prohibited within the Bay. However, an unknown amount of wastes is believed to be illegally discharged directly into estuarine waters. This type of effluent contributes coliform bacteria, biochemical oxygen-demanding substances, nutrients, oil and grease, and suspended solids. In addition, the discharge of ballast water from large commercial vessels has introduced exotic species of aquatic organisms into the estuary. The introduction of exotic species via ship's ballast water has severely disturbed the aquatic communities of San Francisco Bay. The problems of exotic species introductions are discussed in detail in Section 3.3.3. Accidental spills of petroleum products from ships are generally small and result from operator errors, handling accidents at terminals, and damage to ships, but add to chronic pollution. Tanker accidents have resulted in major oil spills in San Francisco Bay.

Contaminants in the atmosphere deposit on both land and water surfaces. Deposition to the land results in transfer to the Bay in stormwater runoff. Available information suggests that direct atmospheric deposition may be a significant pathway for loading of dioxins, PAHs, PCBs, and mercury (Davis et al. 2000).

Water and Sediment Quality in San Francisco Bay

The San Francisco Estuary Regional Monitoring Program for Trace Substances (RMP) began in 1993 to monitor pollutants in the estuary. The RMP is funded by 74 local, State, and federal agencies and companies through their discharge or Bay use permits to monitor water and sediment quality at sites located throughout San Francisco Bay (Thompson et al. 2000). Table 3.2-6 summarizes concentrations of trace metals in the water column in South Bay, Central Bay, and the Northern Reach of San Francisco Bay between 1993 and 2000. Table 3.2-7 summarizes data on trace metals in sediments. Typically in any given year a substantial number of locations within the Bay will have water or sediments that exceed criteria for one or more metals. Central Bay tends to have the lowest concentrations of metals. Table 3.2-8 shows stations that exceeded California Toxics Rule WQC in 1999. The Northern Estuary, and the southern part of South Bay including the Southern Sloughs, had the greatest number of exceedences. No metals in Central Bay exceeded WQC in 1999. Copper, mercury, and nickel were the contaminants that most frequently exceeded criteria in the northern and southern parts of the Bay. In 1997, a wet year, 69 percent of the water samples exceeded one of the water quality guidelines for trace metals (mostly chromium, mercury, and nickel) (Thompson et al. 2000).

Table 3.2-9 shows the ranges of organic contaminants in water samples in the different parts of the Bay between 1993 and 2000. Table 3.2-10 shows the ranges in organic contaminants in sediments between 1993 and 2000. Organic contaminants frequently exceeding criteria in San Francisco Bay samples include DDTs in water samples and PAHs, PCBs, and DDTs in sediment samples.

RMP sampling of fish tissue in San Francisco Bay has indicated that humans may be at risk of exposure to chemicals through consumption of contaminated fish (Thompson et al. 2000). In 1997, mercury exceeded a human health screening value in 44 of 84 samples of fish tissue in the Bay, and PCBs exceeded human health screening values in 51 of 72 samples of Bay fish tissue (Thompson et al. 2000). Other chemicals that exceeded human health screening values in some samples of San Francisco Bay fish tissue included dieldrin, DDTs, chlordanes, dioxin, and dibenzofuran.

3.2.2.3 Project Area (Carquinez Strait and Suisun Bay)

Physical Characteristics

The detailed project area encompasses Carquinez Strait and Suisun Bay. The study area extends from the Carquinez Bridge (Interstate 80) to the western edge of the legally defined Delta, just west of Pittsburg. Carquinez Strait and Suisun Bay are strongly influenced by flows from the Sacramento and San Joaquin Rivers. The response to high river flows is nearly instantaneous in the project area. The responses to high river inflow includes rapid dilution of surface salinity and a large increase in total suspended solids especially during the first large pulse of river flow each year (Cloern et al. 1999).

Carquinez Strait is a deep (mean depth 29 feet), narrow, 12-mile-long waterbody that joins San Pablo Bay with Suisun Bay. The Strait is characterized by a variable salinity regime resulting from fluctuations in freshwater flow from the Sacramento-San Joaquin river system (Corps, EPA, BCDC, RWQCB, and SWRCB 1998). The narrow restriction of the Strait results in strong currents and consequently most of the bottom is sandy substrate. Water in Carquinez Strait is stratified into a two-layer flow, with lighter

Table 3.2-6
Mean and Ranges of Near Total Concentrations of Trace Metals in Water Samples From Different Parts of San Francisco Estuary 1993-2000

Metal (pg/l)	North Bay		Central Bay		South Bay	
	Mean	Range	Mean	Range	Mean	Range
Ag	0.0181	0.002 - 0.1397	0.0086	0.0007 - 0.0715	0.033	0.002 - 0.195
As	2.63	1.21 - 7.69	1.80	0.94 - 2.72	3.06	1.0 - 17.7
Cd	0.055	0.01 - 0.19	0.061	0.016 - 0.127	0.088	0.02 - 0.38
Cr	14.95	1.12 - **198.23***	1.64	0.1 - 9.43	10.66	0.32 - **125.92***
Cu	**5.61***	0.57 - **20.75***	1.69	0.19 - **4.17**	**5.15***	0.43 - **47.0***
Hg	0.0195	0.0006 - **0.126***	0.0041	0.0001 - 0.0208	**0.0299***	0.0006 - **0.73***
Ni	**9.14***	1.8 - **41.3***	2.22	0.33 - 7.31*	**10.3***	1.0 - **107.3***
Pb	1.66	0.15 - 7.38	0.32	0.01 - 1.85	2.37	0.04 - **44.18**
Se	0.179	0.02 - 0.51	0.153	0.02 - 0.39	0.697	0.03 - 7.96
Zn	11.50	1.99 - **94.1***	2.38	0.22 - 9.23	14.85	0.8 - **215.6***

*** = Exceeds San Francisco Basin Plan Objectives**
Bold = Exceeds California Toxic Rule criteria
Source: SFEI 2001

Table 3.2-7
Mean and Ranges of Trace Metals in Sediment Samples From Different Parts of San Francisco Estuary 1993-2000

Metal (mg/kg)	North Bay		Central Bay		South Bay	
	Mean	Range	Mean	Range	Mean	Range
Ag	0.19	0.03 - 0.51	0.21	0.01 - 0.424	0.40	0.04 - 2.0*
As	10.69*	3.6 - 20.62*	9.45*	4.4 - 29.41*	8.20	2.0 - 16.4*
Cd	0.25	0.07 - 0.51	0.17	0.03 - 0.44	0.28	0.04 - 2.1*
Cr	95.5*	51.3 - 154*	84.4*	47.5 - 132*	105*	38 - 238*
Cu	43.5*	10.0 - 75.0*	31.2	7.2 - 50*	40.8*	21.1 - 94.6*
Hg	0.23*	0.02 - 0.56*	0.19	0.015 - 0.4089*	0.30	0.072 - 1.08*
Ni	**91.2**	**52.6 - 153**	**74.2**	47.5* - **123**	**94.8**	44* - **228**
Pb	17.83	4.8 - 43.9	22.88	8.4 - 76.8*	24.98	**9.3 - 52.9***
Se	0.34	0.03 - 3.3	0.26	0.051 - 0.86	0.35	0.06 - 1.27
Zn	109.43	54.38 - 178*	93.35	50 - 143	126.13	61 - 396*

*** = Exceeds ER-L (effects range low)**
Bold = Exceeds ER-M (effects range median)
Source: SFEI 2001

Table 3.2-8
Summary of Trace Elements that Exceeded Water Quality Criteria (WQC) and Guidelines for 1999 RMP Water Samples

			Dissolved						Total																	
			Cu			Ni			Cu			Hg			Ni			Pb			Se			Zn		
	Code	Station	Feb	Apr	Jul	Feb	Apr	Jul	Feb	Apr	Jul	Feb	Apr	Jul	Feb	Apr	Jul	Feb	Apr	Jul	Feb	Apr	Jul	Feb	Apr	Jul
Estuary Interface	BW10	Standish Dam									X	X					X									
	BW15	Guadalupe River										X	X	X	X								X			
Southern Sloughs	C-1-3	Sunnyvale							X	X	X	X	X		X	X	X									X
	C-3-0	San Jose							X	X	X	X	X	X		X	X			X						
South Bay	BA10	Coyote Creek			X				X	X	X			X		X	X									
	BA20	South Bay							X	X	X	X	X		X	X	X									
	BA30	Dumbarton Bridge							X	X	X				X	X	X									
	BA40	Redwood Creek							X																	
	BB15	San Bruno Shoal																								
	BB30	Oyster Point										X			X											
	BB70	Alameda																								
Central Bay	BC10	Yerba Buena Island																								
	BC20	Golden Gate																								
	BC30	Richardson Bay																								
	BC41	Point Isabel																								
	BC60	Red Rock																								
Northern Estuary	BD15	Petaluma River	X	X	X	X			X	X	X	X	X	X	X	X	X									
	BD20	San Pablo Bay							X	X	X	X	X	X	X	X			X							
	BD30	Pinole Point								X			X			X										
	BD40	Davis Point							X	X			X			X										
	BD50	Napa River							X	X	X	X	X		X	X		X								
	BF10	Pacheco Creek							X	X	X	X	X		X	X										
	BF20	Grizzly Bay								X	X		X	X		X	X									
	BF40	Honker Bay							X	X	X	X	X	X	X	X	X									
Rivers	BG20	Sacramento River											X													
	BG30	San Joaquin River											X													

WQC used in this comparison are from the EPA – California Toxics Rule (2000) 304(a) Criteria.
Only compounds that were above criteria or guidelines are listed.
X = Above guideline
– Not available (Note: these are qualified data and therefore can't be evaluated).
Source: San Francisco Estuary Institute 1999.

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Table 3.2-9
Mean and Ranges of Total Organic Contaminant Concentrations in Water Samples From Different Parts of San Francisco Estuary 1993-2000

Organic Contaminant	North Bay		Central Bay		South Bay	
	Mean	Range	Mean	Range	Mean	Range
Sum PAHs (pg/L)	0.036202	0.003 - 0.505	0.014173	0.00094 - .052	0.099628	0.006 - 0.847
Sum PCBs (pg/L)	0.000648	0.000054 - 0.006974	0.000392	0.000037 - 0.002935	0.002068	0.00015 - 0.010313
Chlorpyrifos (pg/L)	0.000297	0.000004 - 0.001416	0.000205	0.000003 - 0.002185	0.000947	0.00007 - 0.01325
Diazinon (pg/L)	0.007420	0.000052 - 0.05835	0.002874	0.000073 - 0.032	0.007489	0.000052 - 0.098003
Sum DDTs (pg/L)	0.000843	0.00018 - **0.006828**	0.000202	0.00003 - 0.000754	**0.001466**	0.000092 - **0.010419**
Sum Chlordanes (pg/L)	0.000172	0.00001 - 0.000781	0.000089	0.000009 - 0.000357	0.000560	0.000016 - **0.0057**
Heptachlor (pg/L)	0.000007	0.000001 - 0.00003	0.000009	0.000002 - 0.000033	0.000010	0.0000011 - 0.00004
Heptachlor Epoxide (pg/L)	0.000036	0.0000011 - 0.000182	0.000026	0.000001 - 0.00014	0.000080	0.000003 - 0.00053
Sum HCHs (pg/L)	0.000509	0.00002 - 0.0017078	0.000559	0.00008 - 0.0012843	0.000993	0.000026 - 0.0075093
Dieldrin (pg/L)	0.000090	0.000002 - 0.00038	0.000054	0.000003 - 0.000264	0.000124	0.000001 - 0.00058
Endrin (pg/L)	0.000028	0.0000015 - 0.00022	0.000017	0.0000016 - 0.000075	0.000055	0.0000017 - 0.000224

Bold = Exceeds California Toxics Rule Criteria
Source: SFEI 2001

Table 3.2-10
Mean and Ranges of Total Organic Contaminant Concentrations in Sediment Samples From Different Parts of San Francisco Estuary 1993-2000

Organic Contaminant	North Bay		Central Bay		South Bay	
	Mean	Range	Mean	Range	Mean	Range
Sum PAHs (pg/L)	965.60	3 - 7461.4*	1931.60	2.8 - 5420*	2055.54	187 - 7532.1*
Sum PCBs (pg/L)	3.13	0.1 - 10.54	8.15	0.2 - 32.6*	21.53	1.2 - **309.7**
Sum DDTs (pg/L)	3.74*	0.1 - 13.9*	4.4*	0.2 - **27.53**	9.59*	0.754 - **126.6**
Sum Chlordanes (pg/L)	0.55	0.0 - 1.44	0.53	0 - 2	2.73	0.1 - 19.7
Heptachlor (pg/L)	0.51	0.2 - 0.825	ND	No Data	0.47	0.1 - 1.1
Sum HCHs (pg/L)	0.41	0.005 - 1.96	0.37	0 - 1.4	0.50	0.021 - 2.95
Aldrin (pg/L)	0.25	0.1 - 0.55	0.32	0.1 - 0.43	0.55	0.18 - 1.5
Dieldrin (pg/L)	0.26	0.007 - 0.8	0.22	0.1 - 34	0.54	0.06 - 2.2
Endrin (pg/L)	0.28	0.1 - 0.593	0.32	0.1 - 0.631	0.52	0.13 - 1.28

*** = Exceeds ER-L**
Bold = Exceeds ER-M
Source: SFEI 2001

freshwater moving seaward in the top layer and heavier saltwater moving upstream on the bottom (San Francisco Estuary Project 1997). This two-layer flow, known as gravitational circulation, is strong in Carquinez Strait except during extremely high outflows when waters in the Strait are completely fresh (San Francisco Estuary Project 1997, Schoellhamer and Burau 1998).

Suisun Bay is a shallow embayment between Chipps Island, at the western boundary of the Delta, and the Benicia-Martinez Bridge. Suisun Bay covers approximately 36 square miles, has a mean depth of 14 feet, and a mean salinity of approximately 7 parts per thousand (ppt) (Corps, EPA, BCDC, RWQCB, and SWRCB 1998). Freshwater from the Sacramento and San Joaquin Rivers usually meets saltwater from the ocean in the vicinity of Suisun Bay. The bottom of Suisun Bay is predominantly fine silt and clay, crossed by channels scoured by tidal and riverine flows. The surficial sediments around these channels change according to season (Corps, EPA, BCDC, RWQCB, and SWRCB 1998). High riverine flows winnow the fine sediment of Suisun Bay and transport it downstream through Carquinez Strait and into San Pablo Bay. As riverine flows decrease, silt again is deposited in Suisun Bay and the surficial sediments again become fine silt and clay.

A biologically significant area of high particle concentration, known as the entrapment zone, typically is located in Suisun Bay. Increasing river flows push the entrapment zone seaward and decreasing river flows allow the entrapment zone to move landward (Schoellhamer and Burau 1998). The entrapment zone is an area of high productivity where nutrients and organisms accumulate and is considered to be important to many aquatic species in San Francisco Estuary. The entrapment zone tends to occur where the surface salinity is between 1 and 6 ppt (Schoellhamer and Burau 1998).

The entrapment zone was formerly believed to occur in the vicinity of the null zone, the location where landward- and seaward-flowing bottom currents converge. Recent studies have shown that the position of the null zone is controlled partly by the movement of the salt field and partly by the bathymetry of the estuary (San Francisco Estuary Project 1997, Schoellhamer and Burau 1998). A semipermanent null zone occurs near the Benicia Bridge, where the change in depth produces upwelling and a maximum in turbidity. Null zones also may occur in the northwest end of Suisun Bay along the mothball fleet, east of the Suisun Cutoff and in the lower Sacramento River, whenever the salinity is above 2 ppt at these locations. Consequently, the null zone is not necessarily located in the same position as the entrapment zone. The complex interactions between movement of the salt field, gravitational circulation, and retention of particles and organisms in the entrapment zone is the focus of much current research.

The amount of Delta runoff greatly affects water column characteristics in the project area and results in a great variance in water quality conditions from year to year. The amount of Delta outflow determines water mass characteristics for much of the project area. Table 3.2-11 shows the water column characteristics for 1999 and 2000 at RMP station BF-10 at Pacheco Creek approximately 1,800 feet from the Shore pier. The water column characteristics at this station would be expected to be similar to those at the pier. Nutrients and chlorophyll-A were slightly on the low side compared to other stations in San Francisco Bay. Dissolved oxygen during 1999 and 2000 was always well above the 5 mg/l considered the minimum oxygen concentration to support aquatic life. Salinity varied from 0 during spring periods of high river outflow to 6.4 to 6.7 ppt during summer. Temperature varied from 9.5 degrees Centigrade in February of 1999, to 19.6 degrees Centigrade in July of 1999.

Table 3.2-11
Water Column Characteristics of Station BF 10 - Pacheco Creek

Parameter	2/99	4/99	7/99	2/00	7/00
Ammonia (mg/L)	0.11	0.07	0.04	0.13	0.09
Chlorophyll-a (mg/m^3)	2.3	5.1	1.6	1.7	1.3
Dissolved Oxygen (mg/L)	10.7	9.7	8.5	9.1	8.3
Nitrate (mg/L)	0.35	0.26	0.51	0.333	0.431
Nitrite (mg/L)	0.009	0.011	0.004	0.017	0.012
Phosphate (mg/L)	0.14	0.02	0.09	0.058	0.081
Salinity (by Salinometer) (psu)	ND	ND	6.4	ND	6.7
Temperature (°C)	9.4	15.9	19.6	11.9	19.2

ND = Not Detected.
Source: SFEI 2001

Water Quality

The San Francisco Bay Basin Plan designates beneficial uses for waterbodies covered by the plan (RWQCB 1995). Designated beneficial uses for waters in the project area (Carquinez Strait and Suisun Bay) include ocean commercial and sport fishing, estuarine habitat, industrial service supply, fish migration, navigation, preservation of rare and endangered species, water contact recreation, non-contact water recreation, fish spawning, and wildlife habitat.

The project area, including both Carquinez Strait and Suisun Bay is on the California 303(d) list of impaired waterbodies for a variety of pollutants (Table 3.2-12). Carquinez Strait and Suisun Bay are on the 303(d) list for chlordane, DDT, diazinon, dieldrin, dioxins, exotic species, furan compounds, mercury, PCBs, and selenium (SWRCB 2002). Suisun Bay also is on the list for nickel.

The greatest source of contaminant input to the project area is nonpoint agricultural runoff into the Sacramento and San Joaquin Rivers. Other local contaminant sources include municipal and industrial dischargers, dredged material disposal, storm runoff, atmospheric deposition, and vessels. Figure 3.2-3 shows major permitted point source dischargers in the project area. Of these, the Central Contra Costa Sanitary District with an average discharge of 52 million gallons per day (mgd) is by far the largest point source discharger to the project area (Davis et al. 2000). The second and third largest dischargers are the Fairfield Suisun Sewer District and the Vallejo Sanitation and Flood Control District, which discharge 17 mgd and 14 mgd respectively to project area waters. All the other permitted point source dischargers to the project area discharge less than 10 mgd each.

Table 3.2-12
Carquinez Strait and Suisun Bay Pollutants, TMDL Priority and Sources of Pollutants in the 2002 California 303(d) List of Impaired Waterbodies

Pollutants/Stressors	Priority	Source
Chlordane (listed by EPA)	Low	Nonpoint Source
DDT (listed by EPA)	Low	Nonpoint Source
Diazinon (diazinon levels cause water column toxicity. Two patterns: pulses through riverine systems linked to agricultural application in late winter and pulse from residential land use areas linked to homeowner pesticide use in late spring, early summer. Chlorpyrifos may also be the cause of toxicity; more data needed, however.)	Low	Nonpoint Source
Dieldrin (listed by EPA)	Low	Nonpoint Source
Dioxin Compounds (listed by EPA)	Low	Atmospheric Industrial Deposition
Exotic Species (disrupt natural benthos; change pollutant availability in food chain; endanger food availability to native species.	Medium	Ballast Water
Furan Compounds (listed by EPA)	Low	Atmospheric Deposition
Mercury (current data indicate fish and wildlife consumption impacted uses. Major source is historic; gold mining sediments and local mercury mining; most significant ongoing source is erosion and drainage from abandoned mines; moderate to low level inputs from point sources.)	High	Industrial Point Sources Municipal Point Sources (Carquinez Strait only) Resource Extraction Atmospheric Deposition Natural Sources Nonpoint Source
Nickel (listed by EPA) – Suisun Bay only	Low	Municipal Point Sources Urban Runoff/Storm Sewers Other
PCBs (non dioxin-like) (interim health advisory for fish; uncertainty regarding water column concentration data.)	High	Unknown Nonpoint Source
PCBs (dioxin-like) (listed by EPA)	Low	Unknown Nonpoint Source
Selenium (affected use is one branch of the food chain; most sensitive indicator is hatchability in nesting diving birds, significant contributions from oil refineries (control program in place) and agriculture (carried downstream by rivers); exotic species may have food chain more susceptible to accumulation of selenium; health consumption advisory in effect for scaup and scoter (diving ducks); low TMDL priority because Individual Control Strategy in place.)	Low	Industrial Point Sources Agriculture Natural Sources (Suisun Bay only)
Source: SWRCB 2002		

Figure 3.2-3 Major Point Source Dischargers in Project Area

There are two dredged material disposal sites in the project area. The Carquinez Strait disposal site (known as “SF-9”) is a 1,000-foot by 3,000-foot rectangle located 0.9 mile west of the entrance to Mare Island Strait at the western end of Carquinez Strait (Corps, EPA, BCDC, RWQCB, and SWRCB 1998). The bulk of the material discharged at this site comes from dredging of the Mare Island Ship Channel. The current disposal volume limitation on this site is 2 to 3 mcy, depending on whether the year is a “normal” or “wet” year respectively. A tracer study done at this site indicated that about 10 percent of the sediment discharged at this site recycled back into Mare Island Strait, while the rest dispersed across a large portion of San Pablo and Suisun Bays (Corps, EPA, BCDC, RWQCB, and SWRCB 1998). The Suisun Bay disposal site (known as “SF-8”) is a 500-foot by 11,200-foot rectangle located along the northern side of the Suisun Bay Channel just offshore from the Shore pier (Corps, EPA, BCDC, RWQCB, and SWRCB 1998). This site is limited to federal project use for materials that are at least 95 percent sand from maintenance dredging of the Suisun Bay Channel. The current disposal volume limitation at the Suisun Bay disposal site is 0.2 mcy.

As shown in Table 3.2-6, concentrations of trace metals in RMP water samples in North Bay are generally considerably higher than in Central Bay, but lower than in South Bay. The exception to this pattern is chromium. The North Bay tends to have higher water column levels of chromium than Central Bay or South Bay. Table 3.2-13 shows recent trace metal data for RMP station BF-10 at Pacheco Creek. The Pacheco Creek station is the RMP station closest to the Shore marine terminal. Some of the samples at this station exceeded WQC for chromium, copper, mercury, and nickel. With the exception of one high value of chromium (122.18 ug/l), concentrations of other metals at Pacheco Creek were generally close to the means for North Bay.

Table 3.2-13
Total Trace Elements in Water Samples From
Station BF 10 – Pacheco Creek

Total Trace Metals (pg/L)	2/99	4/99	7/99	2/00	7/00
Ag	0.007	0.008	0.009	NA	NA
As	1.8	1.79	2.8	2.28	3.41
Cd	0.024	0.041	0.043	NA	NA
Cr	7.03	20.99	**122.18***	NA	NA
Cu	**4.4**	**8.1***	**4.3**	NA	NA
Hg	0.01	**0.0286***	0.0105	0.0162	NA
Ni	**8.5***	**13***	5.5	NA	NA
Pb	1.15	2.67	0.92	NA	NA
Se	0.09	0.05	0.22	ND	0.129
Zn	6	17.3	5.8	NA	NA

NA = Not Analyzed/Not Available. ND= Not Detected.
Bold= Exceeds California Toxics Rule criteria *= Exceeds San Francisco Basin Plan Objectives
Source: SFEI 2001

The RMP does not sample the Pacheco Creek station for organic contaminants in the water column. Concentrations of organic contaminants in North Bay water column samples generally were higher than Central Bay and lower than South Bay (Table 3.2-9).

Sediments

In general, the concentrations of contaminants in North Bay sediments are higher than those in Central Bay sediments and lower than those in South Bay sediments (Tables 3.2-7 and 3.2-9). Lead is an exception to this general pattern. North Bay sediments have a lower mean and range of lead concentrations than Central Bay and South Bay sediment.

Table 3.2-14 shows the concentrations of contaminants in Carquinez Strait and the Bulls Head Channel, offshore from the Shore marine terminal, in Suisun Bay. All samples in Carquinez Strait exceeded the ER-L and San Francisco Estuary Ambient Concentration for chromium (See Section 3.2.2.1 for a definition of San Francisco Bay Estuary Ambient Concentration). All Carquinez Strait samples also exceeded the San Francisco Estuary Ambient Concentration for selenium. All Carquinez Strait samples exceeded the ER-L for arsenic, while some samples also exceeded the San Francisco Estuary Ambient Concentration. In addition some samples in Carquinez Strait exceeded one or more sediment criteria for PAHs, mercury, cadmium, copper, lead, nickel (exceeded ER-M), and zinc. In Bulls Head Channel, all samples exceeded the ER-L and San Francisco Estuary Ambient Concentration for chromium, and all samples exceeded the ER-M for nickel. The higher range of the samples also exceeded the San Francisco Estuary Ambient Concentration for nickel. The higher end of the range of Bulls Head Channel samples exceeded the ER-L for arsenic and the San Francisco Estuary Ambient Concentration for silver.

Tables 3.2-15 and 3.2-16 show 1999 and 2000 sediment contaminant concentrations at the RMP Pacheco Creek station near the Shore marine terminal. All samples exceeded the ER-M for nickel although none exceeded the San Francisco Estuary Ambient Concentration. One sample in 1999 exceeded the ER-L for arsenic and one sample exceeded the San Francisco Estuary Ambient Concentration for cadmium (but not the ER-L). Two samples at the Pacheco Creek station exceeded the San Francisco Ambient Concentration for total PAHs (but not the ER-L) and two samples exceeded the ER-L for total DDT but not the San Francisco Ambient Concentration.

Table 3.2-17 shows recent data on sediments at the Shore marine terminal compared to a Carquinez Strait reference site. Sediments at the Shore terminal were 71.9 percent sand. The only organic contaminants detected at the terminal were low levels of PAHs and TBT. No pesticides or PCBs were detected. No metal at the terminal exceeded the ER-M level. However, arsenic, chromium, copper, lead, mercury, nickel, and zinc exceeded the ER-L level at the Shore terminal. Therefore, sediments at the Shore terminal have some potential to have adverse effects on benthic organisms. Cadmium, copper, lead, mercury, and zinc at the Shore terminal exceeded the San Francisco Estuary Ambient Concentration, indicating that the project site had higher concentrations of these metals than areas of San Francisco Bay considered to be the least impacted by contaminant inputs. The Carquinez Strait reference area had higher concentrations of PAHs, arsenic, chromium, nickel, selenium, and silver than the Shore terminal but lower levels of cadmium, copper, lead, mercury, and zinc. Compared to the

Table 3.2-14
Sediment Contaminant Concentrations in Project Area

Parameters	Bullshead Channel, Suisun Bay	Carquinez Strait
Grain Size (%)		
Gravel	0 - 1	0 - 4
Sand	80 - 97	4 - 94
Silt	0 - 12	3 - 51
Clay	2 - 8	3 - 52
Total Organic Carbon (%)	0.11 - 0.3	0.4 - 2.2
Organic Contaminants (pg/kg)		
Tributyltin	ND	0.6 - 29
Dibutyltin	ND	1 - 12
Monobutyltin	ND	0.7 - 4
Oil and Grease (mg/kg)	NA	9 - 111
TRPH (mg/kg)	0 - 14	12 - 62
DDT and metabolites	ND	ND
Pesticides	ND	ND
total PCBs	ND	ND
total PAHs	4 - 47	26 - **392**
Metals (mg/kg)		
Arsenic	6.2 - 8.8*	8.4* - **21***
Mercury	0.01 - 0.03	0.06 - **0.45***
Selenium	0.1 - 0.2	**0.8 - 1.0**
Cadmium	0.1	0.1 - **0.6**
Chromium	**230* - 334***	**164* - 269***
Copper	17 - 29	17 - **67***
Lead	7 - 12	10 - **34**
Nickel	83* - **106****	81* - **120****
Silver	0.3 - **0.4**	0.03 - 0.3
Zinc	72 - 77	71 - **147**

NA = Not Analyzed / Not Available.
ND = Not Detected.
*** = Exceeds ER-L**
**** = Exceeds ER-M**
bold + Exceeds San Francisco Estuary Ambient Concentrations
Source: Corps, EPA, BCDC, RWQCB, and SWRCB 1998

Table 3.2-15
Sediment Composition and Trace Metal Concentrations of Sediment Samples from Station BF 10 - Pacheco Creek

Parameter	2/99	7/99	7/00
% Clay (< 4pm)	12	17	13
% Silt (4 pm-63 pm)	7	10	9
% Sand (63 pm-2 mm)	81	73	78
Ag (mg/kg)	ND	0.07	0.07
Al (mg/kg)	22350	14738	21802
As (mg/kg)	NA	9.2*	5.45
Cd (mg/kg)	**0.35**	NA	0.14
Cr (mg/kg)	67	55	NA
Cu (mg/kg)	21	22	21.9
Fe (mg/kg)	29529	26381	30817
Hg (mg/kg)	0.06	0.09	0.09
Mn (mg/kg)	533	455	411
Ni (mg/kg)	72**	68**	71.6**
Pb (mg/kg)	7.4	10.9	11.4
Se (mg/kg)	0.09	0.11	0.1
Zn (mg/kg)	76.9	78.4	75.5

NA = Not Analyzed / Not Available.
*** = Exceeds ER-L**
**** = Exceeds ER-M**
Bold = Exceeds San Francisco Estuary Ambient Concentration
Source: SFEI 2001

Table 3.2-16
PAH, PCB, and Pesticide Concentrations in Sediment Samples from Station BF 10 - Pacheco Creek

Parameter	2/99	7/99	7/00
Sum PAHs (pg/kg)	**356**	**323**	190
Sum PCBs (pg/kg)	3.6	2.6	0.3
Sum DDTs (pg/kg)	1.4	2.4*	1.981*
Sum Chlordanes (pg/kg)	0.7	ND	0.238
Heptachlor (pg/kg)	0.2	ND	ND
Sum HCHs (pg/kg)	ND	ND	ND
Aldrin (pg/kg)	ND	ND	NA
Dieldrin (pg/kg)	ND	ND	ND
Endrin (pg/kg)	ND	ND	ND

NA = Not Analyzed / Not Available.
*** = Exceeds ER-L**
ND = Not Detected.
Bold = Exceeds San Francisco Estuary Ambient Sediment Concentration
Source: SFEI 2001

Table 3.2-17
Summary of Sediment Characterization
Shore Terminals

Analyte (1)	Site	SH	Carquinez Reference	Detection Achvd (%)	Limit Reqd (2)
Grain size (%)					
Gravel		0.4	11.1		
Sand		71.9	19.1		
Silt		11.9	29.4		
Clay		16.9	40.8		
Solids (%) (Dry Wt.)		67.6	47.0	0.1	0.1
Sulfides (mg/kg)					
Water Soluble		<0.01	<0.01	0.01	0.1
Total Organic Carbon (%)		0.4	1.68	0.1	0.1
Organotins (pg/kg)					
Dibutyltin		ND	ND	2.0	1.0
Monobutyltin		ND	ND	2.0	1.0
Tetrabutyltin		ND	ND	2.0	1.0
Tributyltin		4	8	2.0	1.0
Metals (mg/kg)					
Arsenic (As)		11.2*	13.6*	0.05	0.1
Cadmium (Cd)		**0.52**	**0.4**	0.05	0.1
Chromium (Cr)		84.3*	**262***	0.05	0.1
Copper (Cu)		**92.7***	**77***	0.05	0.1
Lead (Pb)		**59.5**	25	0.05	0.1
Mercury (Hg)		**0.37**	0.26	0.01	0.02
Nickel (Ni)		28.4*	161**	0.05	0.1
Selenium (Se)		0.57	1.02	0.05	0.1
Silver (Ag)		0.3	0.32	0.01	0.1
Zinc (Zn)		**159***	141	0.05	0.1
PAHs (pg/kg)					
Acenaphthene		8	7	5	20
Acenaphthylene		ND	ND	5	20
Anthracene		7	9	5	20
Benzo(a)anthracene		11	26	5	20
Benzo(a)pyrene		11	17	5	20
Benzo(B)Fluoranthene		ND	15	5	20
Benzo(g,h,i)perylene		10	8	5	20
Benzo(k)fluoranthene		12	15	5	20
Chrysene		11	30	5	20
Dibenzo(a,h)anthracene		ND	ND	5	20
Fluoranthene		41	70	5	20
Fluorene		**13**	**10**	5	20
Ideno(1,2,3-CD)pyrene		7	9	5	20
Naphthalene		7	16	5	20
Phenanthrene		**18**	28	5	20
Pyrene		40	84	5	20
Total PAHs		181	328		

(1) All chemical analyses are given as dry weight basis. *** Exceeds ER-L**
(2) Detection limits required by USACOE. **** Exceeds ER-M**
Bold = Exceeds San Francisco Estuary Ambient Concentration
Source: Advanced Biological Testing 2000

mean and ranges of metal concentrations at RMP North Bay stations between 1993 and 2000 (Table 3.2-7), Shore terminal had higher values of cadmium, copper, and lead than was found at RMP North Bay stations.

3.2.3 <u>Impacts Analysis and Mitigation Measures</u>

Impact Significance Criteria

The significance of impacts was considered in the context of whether the Shore marine terminal's operations would likely result in pollutant levels above ambient water quality and sediment levels and whether increased levels would exceed water quality objectives of the RWQCB or the SWRCB. The significance of impacts was considered in the context of contaminant levels for San Francisco Bay in general and the project area in particular. For example, operations that would result in changes from background that are not discernible in the local area, or region were considered less than significant impacts.

Impacts to marine water quality were considered significant if any of the following apply:

- The water quality objectives contained in the Water Quality Control Plan for San Francisco Basin (RWQCB 1995) (Table 3.2-1 and 3.2-2) are exceeded;

- The WQC in the California Toxics Rule (EPA 2000) (Table 3.2-3) are exceeded; and/or

- Project operations or discharges that change background levels of chemical and physical constituents or elevate turbidity would produce long-term changes in the receiving environment of the site, area, or region that would impair the beneficial uses of the receiving water.

Impacts are considered adverse but less than significant (Class III) if the project could result in elevation of contaminants, but the levels remain below WQC, or if elevation of contaminant concentrations above criteria occurs only within a couple of hundred feet or less of the point of discharge for a few hours or less.

3.2.3.1 Shore Marine Terminal Routine Operations and Potential for Accident Conditions

Impact WQ-1: Sediment Disturbance to Water Quality from Vessel Maneuvers

Disturbed sediments could cause a brief, localized depression in dissolved oxygen concentrations, but would disperse rapidly with the strong tidal currents in the area, and be rapidly mitigated by tidal mixing with Bay waters of high dissolved oxygen concentration. Such events would occur for an hour or less

during a 24-hour period and be limited to the immediate vicinity of the terminal, thus increased turbidity due to vessel traffic would be adverse but less than significant (Class III).

Between 1998 and 2002, an average of 9 tankers and 7 barges visited the Shore marine terminal per month. These vessels and barges are assisted by tugs in berthing and unberthing operations. The number of tugs used in docking or maneuvering of vessels depends on the size of the vessel and environmental conditions. The number can vary from one to as many as four. Berthing operations can affect water quality by propeller wash from tankers and tugs eroding bottom sediments in the immediate vicinity of the Shore pier. Strong tidal currents occur in the vicinity of Shore terminal. The ship's propulsion system is used to compensate for the tidal current and head winds. The large propellers on tankers of large drafts are close to the bottom of the Bay and the turbulence from these propellers can erode bottom sediments. The transit of deep-draft vessels through San Francisco Bay to the wharf can also resuspend sediments and benthic biota in the water column where bottom depths are near that of the vessel draft. The propeller wash from tugs is nearer the surface and has less of an erosion effect on bottom sediments.

Shore terminal has a single berth for vessels. This berth is maintained at a depth of 38 feet MLLW plus an additional 2 feet for an effective depth of 40 feet (R. Brandes, Shore Terminals, personal communication, 2003). The deepest draft vessel that can be accepted at the Shore terminal is 37.5 feet.

Recent sampling of sediment at the Shore terminal indicates that the substrate at the pier is approximately 72 percent sand (ABC 2000). Although propellers and bow thrusters scour sand more readily than hard packed silts and clays, sand settles more quickly than finer grained sediments and generally does not create extensive turbidity plumes the way resuspended silts and clays do.

The resuspension of bottom material from propeller wash and bow thrusters can affect turbidity in the immediate vicinity of vessel operations. The San Francisco Bay Basin Plan water quality objectives specify that waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses (RWQCB 1995). The Basin Plan objective for dissolved oxygen states that for tidal waters downstream of Carquinez Bridge, dissolved oxygen shall not be depressed below 5 mg/l.

A turbid plume of water is often evident in turbulent propeller wash of large deep-draft vessels in relatively shallow harbors and bays. This turbid plume would be short-lived. Observations of turbidity caused by boat wakes indicate that the plume generally persists less than 10 minutes. Depending on the depth of propeller wash scour, sediments might be anaerobic and could cause a brief, localized depression in dissolved oxygen concentrations. This resuspended sediment material would disperse rapidly with the strong tidal currents in the area, and any depression in dissolved oxygen would be rapidly mitigated by tidal mixing with Bay waters of high dissolved oxygen concentration. No increase in turbidity was observed during vessel berthing operations at the Shore terminal during a visit by the EIR project team in August 2002.

Bottom scour conditions may occur when deep-draft vessels are using their propulsion systems while berthing at the Shore terminal. An average of 9 tankers and 7 barges per month, along with their associated tugboats, call at the terminal, and it takes about 1 hour to secure the vessel or barge to the dock. Therefore, turbidity caused by vessels at the terminal would occur less than 5 percent of the time on average [(1 hour for vessel arriving + 1 hour for vessel departing) x (16 vessels per month)/(732 hours per month) = 4.4 percent of the time]. With a maximum of 325 annual vessel calls over the lease period, this could increase to 7.4 percent. Because these events would occur for an hour or less, impacts would be limited to the immediate vicinity of the terminal, increased turbidity due to vessel traffic would be adverse but less than significant (Class III). There is no evidence that turbidity related to vessel traffic is degrading beneficial uses of Carquinez Strait and Suisun Bay.

<u>WQ-1: No mitigation is required.</u>

Impact WQ-2: Segregated Ballast Water

Discharge of ballast water that contains harmful microorganisms could impair several of the project area's beneficial uses, including commercial and sport fishing, estuarine habitat, fish migration, preservation of rare and endangered species, water contact recreation, non-contact water recreation, fish spawning, and wildlife habitat. Therefore discharge of segregated ballast water is determined to have a potentially significant impact to water quality (Class I).

Ballast water is used to stabilize tankers and barges. Ballast water is taken up to compensate for the lightering of vessels bringing crude oil or products to the Shore terminal. Segregated ballast water is kept in tanks that are segregated from oily cargo. Sometimes, however, ballast may be taken into cargo holds where it will come in contact with oil. Nonsegregated ballast water is considered a hazardous waste in California and cannot be discharged to Bay or coastal waters. If nonsegregated ballast water must be unloaded at the Shore terminal, it is transferred to a truck provided by a contractor and taken to a suitable waste handling facility (R. Brandes, Shore Terminals LLC, Personal Communication 2002).

Vessels may discharge ballast water from segregated ballast tanks into San Francisco Bay as they take on product from the Shore terminal or during transfer of product from a larger vessel to a smaller vessel or barge at Anchorage No. 9. This ballast water contains the pollutants present in the water at the port where it was taken on. If this water contains higher levels of pollutants than are present in San Francisco Bay, discharge of this water could have an adverse water quality impact. Because the ballast tank is segregated, no pollutants are transmitted to the ballast water from the cargo and little, if any, pollutants occur from leaching of material from segregated ballast tanks. In addition, ballast water contains an assemblage of organisms living in the water where the ballast was taken on.

Ships that visit the Shore marine terminal follow an established pattern from as far south as San Pedro, California, to as far north as the Cook Inlet in the Gulf of Alaska. The levels of certain pollutants in some of those ports may exceed ambient levels in Suisun Bay. In cases where the pollutant in ballast water exceeds the concentration in San Francisco estuary, the volume of water discharged (2.5 million gallons) is small compared to the volume of water in San Francisco Bay so that concentrations in discharged ballast water would reach background levels rapidly. Therefore, the discharge of segregated ballast water at the Shore terminal or Anchorage No. 9 is not expected to result in long-term elevations of contaminant levels that exceed criteria in the California Toxics Rule.

On the other hand, non-indigenous organisms in ballast water may have significant adverse impacts to biological resources and water quality. Impacts to biological resources are discussed in Section 3.3. Release of segregated ballast water could have a significant adverse impact to water quality if viruses, toxic algae or other harmful microorganisms were released. Suisun Bay and Carquinez Strait are on the 303(d) list of impaired waterbodies for exotic species. Harmful algal blooms have been associated with such adverse effects as mass mortalities of pelicans and sea lions (attributed to the toxin domoic acid produced by the diatom *Pseudo-nitzchia australis*) off coastal California (Committee on Environment and Natural Resources 2000). Ballast water discharges have been implicated as one mechanism for the spread of harmful algae. Mid-ocean exchange reduces reproduction of exotic organisms but is not completely effective. One study of the ballast water of ships that had conducted mid-ocean exchange showed that ships that exchanged ballast water had 5 percent of the number of organisms and half the number of species compared to ships that did not exchange (Cohen 1998). Another study showed that 14 of 32 ships that conducted mid-ocean ballast exchange retained significant amounts of sediment and dinoflagellate cysts. Discharge of ballast water that contains harmful microorganisms could impair several of the project area's beneficial uses, including commercial and sport fishing, estuarine habitat, fish migration, preservation of rare and endangered species, water contact recreation, non-contact water recreation, fish spawning, and wildlife habitat. Therefore discharge of segregated ballast water is determined to have a potentially significant impact to water quality (Class I).

<u>Mitigation Measures for WQ-2</u>:

WQ-2: Because the Shore terminal does not have any facilities to treat ballast water for microorganisms, Shore shall ensure that any vessel using its terminal complies with the California Marine Invasive Species Control Act (Public Resources Code Sections 71200 through 71271. See Appendix E for key components of the Act). Vessels must exchange their ballast water in mid-ocean waters, before entering the waters of the state or they must retain all ballast water on board the vessel (Public Resources Code Section 71204.2). Vessels that have not complied with the Act shall not be allowed to moor at the terminal. Shore shall complete a ballast water reporting form, as approved by CSLC, for each vessel using the terminal and fax it to the Ballast Water Program within 24 hours. This reporting form shall state the ballast water source and where the vessel discharged ballast water. Shore Terminals and CSLC staff shall meet annually every March throughout the lease term, discuss the effectiveness of this mitigation measure, and make adjustments to the implementation of this measure. Shore Terminals shall adhere to the current "Ballast Water Management for Control of Nonindigenous Species" as a part of Public Resources Code Section 71200 until January 1, 2010 or any date extension thereof. This measure will provide a tracking mechanism and shall remain in effect until such time that more stringent requirements are developed.

Rationale for Mitigation: Shore Terminals has no facilities to treat ballast water for organisms, and it likely would not be economically feasible to construct a system for treating ballast water to remove exotic species. Furthermore, effective systems for the treatment of ballast water to remove all associated organisms have not yet been developed. The measure provides an interim tracking mechanism until a feasible system to kill organisms in ballast water is developed, the discharge of ballast water to San Francisco Bay will remain a significant adverse impact. Mid-ocean exchange reduces the introduction of exotic species but is not completely effective.

Residual Impacts: Until a feasible system to kill organisms in ballast water is developed, the discharge of ballast water to San Francisco Bay will remain a significant adverse impact (Class I).

Impact WQ-3: Other Vessel Wastes

Cooling Water

Cooling water discharges on water quality would be less than significant (Class III) as the increase in water temperature of the Bay would be negligible and would not exceed limitations set forth in the California Thermal Plan.

Besides the discharge of segregated ballast water discussed above, the only other discharge from vessels visiting the Shore terminal is cooling water flow from the ships operating systems. Cooling water flow from ship systems includes flow from the main engines and auxiliary equipment operating during the time the ships are berthed at the wharf. The volume of these cooling water flows is relatively small compared to the tidal flow past the wharf. Therefore, the increase in water temperature of the Bay would be negligible and would not exceed limitations set forth in the California Thermal Plan. The impact of cooling water discharges on water quality would be less than significant (Class III).

Trash

Trash associated with terminal operations is disposed of by a contracted garbage disposal firm, thus impacts are less than significant (Class III).

Vessels are not allowed to offload trash. Therefore, trash would not be discharged to Bay waters and impacts of trash on water quality would be less than significant (Class III).

Other Liquid Wastes

Spills of sanitary wastewater, bilge water, and non-segregated ballast water, could degrade water quality and many spills would constitute chronic long-term degradation of water quality, resulting in a significant adverse impact (Class II).

Any other liquid wastes that may need to be removed from vessels visiting the Shore terminal are discharged to tanker trucks provided by a contractor and taken to an appropriate waste handling facility. Therefore, unless there was a spill during transfer, none of these other wastes, which might include sanitary wastewater, bilge water, and non-segregated ballast water, would have any impact on water quality in the project area. A spill, however, would degrade water quality and many spills would constitute chronic long-term degradation of water quality, resulting in a significant adverse impact (Class II).

Mitigation Measures for WQ-3:

WQ-3: Shore shall prepare a SWPPP for the marine terminal that includes Best Management practices (BMPs) specifically to prevent leaks and spills during transfer of liquids between vessels and trucks on the wharf. The SWPPP shall be prepared within 6 months of lease implementation and reviewed by the CSLC and be available to the RWQCB.

Rationale for Mitigation: Aggressive implementation of BMPs to reduce the input of chemicals to the Bay from operations on the wharf would reduce the Shore marine terminal's input of these chemicals to adverse but less than significant.

Impact WQ-4: Cathodic Protection

The slow leaching of zinc anodes may increase metal concentrations, but due to the slow rate of exchange of the anodes to seawater, the impact of cathodic protection on water quality is less than significant (Class III).

Tankers and barges calling at the Shore terminal are made of steel and need cathodic protection. Many of these vessels have a coaltar-epoxy coating on their hull that insulates them from the saltwater. Tankers often use an impressed current system for cathodic protection. Barges typically use sacrificial zinc anodes for cathodic protection. The slow leaching of zinc anodes may increase metal concentrations in the waters at the Shore terminal, but due to the slow rate of exchange of the anodes to seawater, it is thought to be negligible in comparison to ambient zinc in the marine environment. The impact of cathodic protection on water quality is less than significant (Class III).

WQ-4: No mitigation is required.

Impact WQ-5: Anti-Fouling Paints

Marine anti-fouling paints are highly toxic containing copper, sodium, zinc, and tributyltin (TBT) and their use on vessels associated with the Shore terminal is considered to be a significant adverse impact to water quality that cannot be mitigated to less than significant (Class I).

Marine anti-fouling paints are used to reduce nuisance algal and marine growth on ships. These marine growths can significantly affect the drag of the vessel through the water and thus its fuel economy. Anti-fouling paints are biocides that contain copper, sodium, zinc, and TBT as the active ingredients. All of these are meant to be toxic to marine life that would settle or attach to the hull of ships. At a November 1997 session of the IMO Assembly in London, a resolution was approved that calls for the elimination of organotin biocides after 2003. The resolution language bans the application of tin biocides as anti-fouling agents on ships by January 1, 2003, and prohibits the presence of tin biocides after January 1, 2008. The Marine Environment Protection Committee of the IMO is developing a legal instrument to enforce the ban of TBT on vessels (Lewis 2001). Much concern has been raised about TBT effects on non-target marine species. New types of bottom paints that do not contain metal based biocides are being developed and tested. Some of these coatings, such as self-polishing coatings, are now in use. Because of the high toxicity of organotins to marine organisms, the use of these substances on vessels associated with the Shore terminal is considered to be a significant adverse impact to water quality that cannot be mitigated to less than significant (Class I).

<u>Mitigation Measures for WQ-5</u>:

WQ-5: Shore Terminals shall require that vessel operators document that vessels using the marine terminal have had no new applications of TBT or other metal-based anti-fouling paints applied after January 1, 2003. Beginning in 2008 Shore Terminals shall require deny moorage to vessels mooring at its dock without prior proof of compliance with the IMO mandate prohibiting the presence of organotin-based biocides on ship hulls.

<u>Rationale for Mitigation</u>: Until all TBT is phased out by 2008, vessels with old applications of TBT on their hulls will visit the Shore terminal. Although it is reasonable for Shore Terminals to require vessels to document no new TBT applications (per IMO mandate), Shore Terminals cannot feasibly require vessels to remove TBT from their hulls until the IMO mandate prohibiting the presence of TBT on shiphulls comes into effect in 2008. Therefore, until all TBT is gone from vessels using the Shore marine terminal, impacts of organotins will remain significant.

<u>Residual Impact</u>: Until all TBT is gone from vessels using the Shore marine terminal, impacts of organotins will remain significant (Class I).

Impact WQ-6: Tanker Maintenance

Routine vessel maintenance would have the potential to degrade water quality due to chronic spills during transfers of lubricating oils, resulting in adverse significant (Class II) impacts.

Minor repair and routine maintenance of vessels may occur at the Shore terminal. Most of these repairs have little effect on water quality. Vessels may take on lubricating oils from trucks at the wharf, which have a potential to spill into the water. All transfer areas (i.e., work areas around risers, loading arms, hydraulic systems, etc.) are protected by berms and drain to sumps from which wastes are pumped onshore. No hull cleaning occurs at the Shore terminal. Routine vessel maintenance would have the potential to degrade water quality due to chronic spills during transfers of lubricating oils. The impact of chronic spills is adverse and significant (Class II).

Mitigation Measures for WQ-6:

WQ-6: Mitigation measure WQ-3 applies which addresses preparation of a SWPPP for the marine terminal.

Rationale for Mitigation: Aggressive implementation of BMPs to reduce the input of chemicals to the Bay from operations on the wharf would reduce Shore Terminals' input of these chemicals to adverse but less than significant.

Impact WQ-7: Stormwater Runoff from the Wharf

Stormwater runoff from the Shore terminal may contribute pollutants to the Bay in concentrations that may adversely affect some benthic species within the local area, resulting in a significant adverse impact (Class II) to water quality.

Stormwater runoff is the largest contributor of pollutants to San Francisco Bay (Davis et al. 2000). Hydrocarbons and other contaminants that accumulate on surfaces of the Shore terminal pier will run off to the ocean during storms. As described in Section 2.2.2, a 6-inch high curb surrounds the wharf deck and all materials on the surface drain into a 25-barrel capacity sump. The sump pumps the contents through a 2-inch oil slop line to an onshore oil-water separator. This is primarily a stormwater collection sump, though it can also serve to contain a product discharge. The sump is normally empty, but does collect flush down water and/or stormwater after rainfall. The sump is open to visual inspection, which is done daily by the wharf technician. During periods of rainfall, the sump is inspected frequently to ensure the float valve is operating properly. The terminal is manned 24 hours per day, which makes this a viable procedure to avoid overfilling the sump. Should the float valve fail, the technician would observe a rise in the level of the sump during his inspection, and the manual switch would be activated. Should the manual switch also fail, a vacuum truck would be used to empty the sump. The float valve is designed to activate when the sump contains approximately two feet, or 300 gallons, of impacted water. Should the switch fail to activate, the sump still has 150 percent additional capacity. In the worst case, the sump would overflow into the concrete curb containment system that surrounds the wharf. Hence, pollutants that accumulate on the wharf deck should not enter the Bay and degrade water quality. However, there is the potential for contaminants to accumulate on the surface of other parts of the pier from routine vehicle use, maintenance activities, and other operations. The Shore terminal Storm Water Pollution Prevention Plan (SWPPP) does not that specifically address the potential for pollutant input from the wharf.

Concentrations of a number of contaminants in sediments at the Shore terminal are at levels that exceed the ER-L indicating that some adverse biological effects may occur to species sensitive to these contaminants (Table 3.2-17). Several of these contaminants exceed the concentrations at a nearby reference site and also are above average levels for North Bay (Table 3.2-7) and San Francisco Estuary Ambient Sediment Concentrations (Table 3.2-5). Therefore, contamination from the Shore terminal may be contributing pollutants to the Bay and concentrations may affect some benthic species adversely within the local area. Because contaminant levels in the vicinity of the Shore terminal exceed criteria, any runoff from the pier is considered to have a significant adverse impact (Class II) to water quality.

<u>Mitigation Measures for WQ-7</u>:

WQ-7: As per mitigation measure WQ-3, Shore shall prepare a SWPPP for the marine terminal. Shore Terminals shall implement additional BMPs to reduce the input of chemicals to the Bay from the marine terminal, including (at a minimum) (1) conducting all vehicle maintenance on land not over water or marshland, (2) berming all areas on the pier where maintenance activities are being conducted and cleaning up all spilled contaminants before berms are removed, (3) washing the surface of the pier to the extent practical and directing washwater into sumps, (4) maintenance of sumps, and (5) posting signs to educate all workers to the importance of keeping contaminants from entering the Bay.

<u>Rationale for Mitigation</u>: Aggressive implementation of BMPs to reduce the input of chemicals to the Bay from stormwater runoff would reduce Shore Terminals' input of these chemicals to adverse but less than significant.

Impact WQ-8: Maintenance Dredging

The effects of dredging and dredged material disposal on water quality are regulated and subject to acquisition of a dredging permit prior to dredging, thus impacts on water quality are adverse but less than significant (Class III).

Shore Terminals dredges sediment from the north side of the wharf in order to maintain an adequate depth for tankers that visit the terminal. Historically, approximately 3,000 to 6,000 cubic yards of sediment have been dredged to maintain adequate depth at the berth. In the past, the dredged sediments were disposed of at the Carquinez Strait Disposal Site (SF-9). Future dredged sediment disposal would be in accordance with the Long Term Management Strategy for Placement of Dredged Material in the San Francisco Bay Region (Corps, EPA, BCDC, RWQCB and SWRCB 1998).

Sediments at the Shore terminal are sampled and analyzed approximately every 3 years to provide information to support application for Shore Terminals maintenance dredging permit. Sediments at the Shore marine terminal are composed primarily of sand sized particles (Table 3.2-17). As discussed above, the concentrations of several contaminants exceeded the ER-L concentration, and several of these contaminants also exceeded the concentration at the Carquinez Strait reference site. However, toxicity tests have indicated that sediments from the Shore terminal have relatively low toxicity to marine organisms (ABC 2000). Because the concentrations of some contaminants at the Shore terminal exceed the concentration in reference sediments, disposal of dredged sediments at the Carquinez Disposal Site or another in-bay disposal site has some potential to increase contaminant levels at the disposal site. However, disposal of approximately 6,000 cubic yards of sediment per year represents a less than significant amount of the 2 to 3 million cubic yards per year that may be disposed of at the Carquinez Strait site.

Dredging and disposal of sediments from the Shore terminal may have an adverse effect on water clarity. However, because the sediments consist primarily of sand-sized particles, resuspended sediments would settle rapidly within a short distance and elevation of turbidity would be short-lived. Resuspension of dredged sediments is not expected to expose marine organisms to toxic concentrations of contaminants, because of the low toxicity of the Shore terminal sediments. Monitoring of water column chemicals during dredging projects in San Francisco Bay indicated that contaminant concentrations did not exceed water quality objectives (Corps and Contra Costa County 1997).

Dredged material disposal in San Francisco Bay is regulated by the interagency Dredged Materials Management Office (DMMO). This interagency group evaluates the physical and chemical characteristics of the dredged sediments to make sure that they are compatible for in-water disposal in the Bay. Because the effects of dredging and dredged material disposal on water quality are transitory and because sediment composition is evaluated by the DMMO before a dredging permit is issued, the impacts of maintenance dredging at the Shore marine terminal on water quality are determined to be adverse but less than significant (Class III).

<u>WQ-8: No mitigation is required.</u>

Impact WQ-9: Oil and Product Leaks and Spills at the Shore Terminal

Potential impacts on water quality can result from leaks or spills. Small leaks or spills (less than 50 bbl) related to Shore operations could result in significant (Class II) impacts, while large spills (greater than 50 bbl) could result in significant adverse impacts (Class I).

To accurately assess the impacts of petroleum spills and chronic petroleum discharges to the marine environment, it is necessary to know the make up of the crude oil or product spilled and the physical, chemical, and biological processes that transform petroleum hydrocarbons spilled in the marine environment. Several comprehensive reviews describe the fate and behavior of petroleum introduced into the marine environment (NRC 1985; Jordan and Payne 1980; Rytkonen, Hirvi, and Hakala 1991).

A wide range of crude oil, feed stocks, additives, and processed petroleum products are transferred through the Shore terminal between its upland storage facilities and vessels that call at the pier. During the last four years, vessels at the Shore marine terminal have received between 12,245,028 and 21,360,335 barrels per year from the Shore Terminal tank farm and have delivered between 2,836,945 and 5,342,674 barrels per year (Table 2.2-2). The Shore terminal handles a variety of light and dark petroleum products and oxygenates. Light products handled by the facility include finished gasoline, gasoline components and blend stocks, jet fuels, diesel fuels, and cutter stocks. Dark products include crude oils, gas oils, residual materials, condensates and other refinery petrochemical feedstocks. Oxygenates have been handled at the Shore terminal including MTBE, but have been phased out.

Crude oils vary widely in appearance and viscosity from field to field. Within the same field, the properties of crude oil vary greatly depending on the season and other environmental factors when the oil was extracted (Chambers Group 1994). Crude oil and petroleum products are complex substances. Crude oil typically is a mixture of several hundred distinct compounds, most of them hydrocarbons, containing hydrogen and carbon in various proportions. When crude oil is distilled into petroleum products, it is essentially sorted into fractions by the boiling temperature of these hundreds of compounds. Boiling temperature is strongly correlated with the number of carbon atoms in each molecule. Therefore, some petroleum products have low boiling temperatures and relatively simple molecules with few carbon atoms, while others have higher boiling temperatures, larger molecules, and more carbon atoms per molecule. The higher the boiling temperature, the greater the density of the resulting product.

Refiners control the mix of hydrocarbon types in particular products in order to give petroleum products distinct properties. Hydrocarbons in the C2-C4 range are all natural gas liquids; hydrocarbons in the C5-C10 range predominate in gasoline; and C12-C20 comprises middle distillates, which are used to make diesel fuel, kerosene, and jet fuel. Larger molecules generally wind up as lubricants, waxes, and residual fuel oil. Each of the hydrocarbons has distinctive characteristics and differs in density, vapor pressure, and solubility. Therefore, the fate of spilled oil in water varies significantly depending on the make up of the oil spilled.

The fate of spilled oil in the marine environment is determined by a variety of complex and interrelated physical, chemical, and biological transformations. The physical and chemical processes involved in the “weathering” process of spilled oil include evaporation, dissolution and vertical mixing, photochemical oxidation, emulsification, and sedimentation. The rate of these weathering processes is influenced by a variety of abiotic factors (e.g., water temperature, suspended particulates, water clarity), physical-chemical properties inherent to the oil itself (e.g., vapor pressure, solubility, aromatic, asphaltene, and wax content), and the relative composition of the hydrocarbon source matrix (e.g., crude oil or refined products). The mass fraction of aromatic present in a crude oil is an important indicator of potential toxicity of a spill, because aromatics are considered the most toxic hydrocarbons in oil (Galt et al. 1991). The asphaltene and wax content determines water-in-oil emulsion formation and is an indicator of how well crude oil will form a stable emulsion or mousse in seawater.

The biological processes involved in the weathering of spilled oil include microbial degradation and uptake of hydrocarbons by larger organisms and its subsequent metabolism. The biodegradation of petroleum by microorganisms is one of the principal mechanisms for removal of petroleum from the marine environment. Enhancement of natural biodegradation processes by microbes may be one of the least ecologically damaging ways of removing oil from the marine environment. Uptake of hydrocarbons by large organisms usually has adverse impacts in the biota because of the toxicity of petroleum hydrocarbons.

Several competing forces occur simultaneously once oil has been released into the marine environment. The processes affecting the fate of spilled oil include (1) advection (drift) and spreading, (2) evaporation, (3) dissolution, (4) dispersion, (5) emulsification, (6) photo-oxidation/auto-oxidation, and (7) sedimentation. Advection or drift is measured by the movement of the center of mass of an oil slick and is primarily controlled by wind, waves, and surface currents. Spreading of oil on water is probably the most significant process for the first 6 to 10 hours following a spill. Gravitational, inertial, and frictional forces are responsible for spreading oil. As spreading occurs, the volatile fractions of the oil are lost to evaporation or dissolution, leading to an increase in the viscosity and specific gravity of the remaining oil. Depending on the product spilled, the rate of evaporation can be important in determining if impacts occur. Spills of refined products, such as kerosene, gasoline, aviation fuel, and jet fuel, may completely evaporate within 24 hours of the spill. Evaporation can account for up to 50 percent of a crude oil spill being lost during the first 24 to 48 hours. Evaporation depends on the physical properties of the spilled oil and on sea state, intensity of solar radiation, wind velocity, and air and sea temperatures.

Because of the low aqueous solubility of most hydrocarbon components of crude oil, dissolution is less important than evaporation. Salinity, temperature, and turbulence of seawater affect the dissolution rate of each hydrocarbon component. The more soluble petroleum hydrocarbons are those with the greatest aromatic and olefin characteristics. For example, the toxic polynuclear aromatics are more soluble in seawater than the relatively nontoxic, longer chain paraffins.

The movement of small particles, or globules, of oil into the water column (dispersion) is believed to be caused by propulsion of surface turbulence (wind, waves, and ship traffic). Such oil-in-water emulsions are not stable and can only be stabilized by natural or added emulsifiers, detergents, dispersants, or suspended particulates. Generally, an oil spill will begin to disperse immediately, and by 100 hours, dispersion has overtaken spreading as the principal mechanism for distributing spilled oil (SAIC 1984).

Emulsification arises from the dispersion of spilled oil and represents a change of state from an oil-in-water dispersion to a water-in-oil emulsion. Crude oils with high asphaltene content or high viscosity form mousse emulsions more than paraffin crude oils (Bocar and Gatellier 1981, cited in NRC 1985). Lighter petroleum distillates, such as gasoline, kerosene, aviation fuel, jet fuel, and diesel fuel oils, do not form mousse (NRC 1985).

Photo-oxidation (the action of sunlight in the presence of oxygen) is a long-term weathering process, which can degrade toxic components in petroleum. For example, potential carcinogens such as benzo[a]pyrene have been shown to be photo-oxidized by sunlight. Oil that evaporates is photochemically oxidized in the atmosphere. In surface water, photo-oxidation may be important on a time scale of minutes to days.

Sedimentation and sinking of spilled oil is caused by sorption of particulates and ingestion of hydrocarbons by zooplankton. Weathering processes increase the density of oil, which leads to incorporation of particulates and the agglomeration of oil-particulate mixtures that eventually sink. In general, extensive weathering is required before the oil residual has a specific gravity greater than that of seawater. Some weathering and fractionation of oil appears to be necessary before incorporation into suspended material. Test tank studies have shown that fractionation of oil is common before it is incorporated into suspended particulate material.

A significant impact to marine water quality (Class I or II impact) would result from changes in water chemistry from an accidental spill of crude oil or oil product at the Shore terminal. Spill probabilities are presented in Section 3.1. Shore Terminals' operations at the site have the greatest potential for small spills (less than 50 bbl). The containment and cleanup capability at the Shore terminal is detailed in Section 3.1.

Physical properties affected by an oil spill include reduced wind stress and thus reduced water surface mixing which limits the exchange of dissolved oxygen between the water and the atmosphere, reduced light transmissivity, and reduced solar warming of the sea surface. The total sea surface area affected by a spill depends on the volume of oil released and the prevailing meteorological conditions, particularly winds.

Most small leaks or spills (less than 50 bbl) related to operations at the Shore terminal could result in significant, adverse (Class II) impacts that can be mitigated to less than significant, because they could be easily contained. However, the severity of impact from larger leaks or spills (greater than 50 bbl) at the marine terminal depends on (1) spill size, (2) oil composition, (3) spill characteristics (instantaneous vs. prolonged discharge), (4) the effect of environmental conditions on spill properties due to weathering, and (5) the effectiveness of cleanup operations. In the event of an oil spill, the initial impacts would be to the quality of surface waters and the water column, followed by potential impacts to sedimentary and shoreline environments. Following an oil spill, hydrocarbon fractions would be partitioned into different regimes and each fraction would have a potential impact on water quality. Large spills (greater than 50 bbl) at the Shore terminal pier could result in significant adverse impacts (Class I) on water quality.

The duration of potential impacts to water quality is variable and depends on the type of oil spilled. The most toxic period for crude oil spilled is the first few days due to volatile, low molecular weight hydrocarbons (BLM 1980). Product spills of gasoline and fuels may evaporate faster than crude oil, but are generally more toxic and more soluble. Toxicity tests performed on oil by the EPA have shown that aromatic constituents are the most toxic, naphthenes and olefins are intermediate in toxicity, and straight chain paraffins are the least toxic (Chambers Group 1988).

Mitigation Measures for WQ-9:

WQ-9: Mitigation measures OS-3a through OS-3d (Operational Safety/Risk of Upset) shall be implemented.

Rationale for Mitigation: These measures provide greater safety in preventing spills and improving response capability and help to reduce impacts to water quality to the maximum extent feasible. Small leaks or spills resulting from Shore Terminals operations that can be easily contained would result in adverse but less than significant impacts.

Residual Impacts: Large spills at the Shore terminal (greater than 50 bbls) may result in significant adverse impacts (Class I) on water quality.

3.2.3.2 Oil Spills from Vessels in Transit in Bay or along Outer Coast

Impact WQ-10: Water Quality Impacts from Accidental Spills

A significant impact to water quality (Class I or II impact) could result from leaks or an accidental spill of crude oil or oil product from a vessel spill along tanker routes either in San Francisco Bay or outer coast waters.

The fate and water quality impacts of oil from a spill associated with vessels servicing the Shore terminal would be similar to the impacts described above for a spill at the terminal. A significant impact to water quality (Class I or II impact) would result from an accidental spill of crude oil or oil product from a vessel transiting San Francisco Bay or outer coast waters. A larger oil spill is more likely from accidents associated with vessels in transit than a spill at the marine terminal. Most tanker spills/accidents and larger spills that cannot be quickly contained either in the Bay or along the outer coast would result in significant, adverse (Class I) impacts.

Mitigation Measures for WQ-10:

WQ-10: Shore Terminals shall implement mitigation measures OS-8a and OS-8b of the Operational Safety/Risk of Upset Section addressing potential participation in VTS upgrade evaluations, and Shore response actions for spills at or near the terminal.

Rationale for Mitigation: Response capability for containment and cleanup of vessel spills while transiting the Bay or outer coast is not Shore's responsibility. However, Shore's participation in these measures, particularly for providing response capability for spills near the terminal can help to reduce the consequences to water quality by increasing response capability. Impacts to water quality from spills near the terminal caused by transiting vessels may be able to be reduced to less than significant with early containment by Shore Terminals staff with implementation of OS-8b.

Residual Impacts: Even with these measures, the residual impacts to water quality may remain significant (Class I).

3.2.4 Alternatives

3.2.4.1 No Project

Impact WQ-11: Effects on Water Quality with No New Shore Terminals Lease

The alternative would eliminate the water quality impacts associated with wharf operations at the Shore terminal resulting in a beneficial (Class IV) impact. Water quality impacts (Class I, II and III) would be transferred to other marine terminals and would be similar to the Proposed Project. Shore has no responsibility for these other terminals.

The No Project Alternative would eliminate the water quality impacts associated with operations at the Shore terminal. The transfer of tanker traffic from the Shore terminal to another marine terminal would eliminate inputs of contaminants from runoff from the Shore terminal pier, as well as some of the small leaks and spills that enter the water directly from terminal operations. In addition, the No Project Alternative would eliminate the temporary water quality impacts associated with maintenance dredging to maintain adequate depth at the berth. Because the additional tanker traffic at another marine terminal would not be expected to increase significantly the quantity of contaminants in stormwater runoff from the other terminal or needed maintenance dredging, this alternative would have fewer impacts to water quality than continued terminal operations at Shore Terminals. Water quality impacts associated with vessels would be transferred to another marine terminal and would be similar to the Proposed Project. These impacts include turbidity generated by boat propellers and bow thrusters, introduction of exotic organisms in ballast water discharges, discharge of heated cooling water, introduction of toxins used as anti-fouling agents on tankers, and introduction of metals from cathodic protection on vessels. These potential impacts of spills on water quality would remain similar to the Proposed Project, but would be transferred to another marine terminal.

If the No Project Alternative involved removal of the Shore terminal pier, temporary impacts to water quality would occur by the disturbance of sediments during pier removal. These impacts would be short lived and are considered adverse but less than significant (Class III).

WQ-11: No mitigation is required.

3.2.4.2 Increased Use of Existing Pipelines for Continued Operation of Upland Facility Alternative

Impact WQ-12: Continued Shore Upland Operations via Existing Pipelines

Increased use of existing pipelines would have no impacts from routine operations. A pipeline spill or substantial leak that would reach a creek, stream, lake, or other water body could result in a significant, adverse (Class I or II) impact to water quality, depending on whether the spill could be easily contained.

Except in the case of an accident, no impacts to water quality would occur from the increased use of pipelines. In the event of a pipeline break and spill or substantial leak, there is the potential that water quality could be compromised if the oil reached a creek, stream, lake, or other water body. This could result in a significant, adverse (Class I or II) impact depending on whether the spill could be contained easily and whether a water body is affected.

Although a significant impact to water quality can occur from a pipeline leak or spill, it is less likely to have significant water quality impacts than a spill associated with tanker operations. In many cases, pipeline leaks or spills may be contained and cleaned up before Bay waters would be contaminated.

<u>Mitigation Measures for WQ-12</u>:

WQ-12: Implementation of OS-10b.

<u>Rationale for Mitigation</u>: OS-10b refers to mitigation measure GEO-14 adhering to proper engineering design, inspection, maintenance and retrofitting of pipelines.

<u>Residual Impacts</u>: Significant adverse water quality impacts (Class I) could occur if significant amounts of oil reached a waterbody.

3.2.4.3 Modification to Existing Pipelines for Continued Operation of Upland Facility Alternative

Impact WQ-13: Continued Shore Upland Operations via Modifications to Existing Pipelines

Because the PG&E fuel oil line that would be used for this alternative is currently inactive, implementation of this alternative would place risk of a leak or spill in a pipeline where no such risk exists currently. Once constructed, no impacts should occur from routine operations. Significant, adverse (Class I or II) impacts to a waterbody could occur, depending on whether the spill could be easily contained.

The impacts of modifying an existing pipeline to allow continued operation of the upland facility would be similar to those of using existing pipelines discussed above in Section 3.2.4.2. In the event of a pipeline break and spill or substantial leak, there is the potential that water quality could be compromised if the oil reached a creek, stream, lake, or other water body. This could result in a significant, adverse (Class I or II) impact depending on whether the spill could be contained easily and whether a water body is affected. Because the PG&E fuel oil line that would be used for this alternative is currently inactive, implementation of this alternative would place risk of a leak or spill in a pipeline where no such risk exists currently. However, a spill or leak from a pipeline is less likely than from tanker operations. Pipeline leaks and spills also are usually more readily contained and cleaned up than spills from tankers. Therefore, this alternative would have lower risk of significant adverse impacts to water quality than the Proposed Project.

Mitigation Measures for WQ-13:

WQ-13: Implementation of OS-10b.

Rationale for Mitigation: OS-10b refers to mitigation measure GEO-14 adhering to proper engineering design, inspection, maintenance and retrofitting of pipelines.

Residual Impacts: Significant adverse water quality impacts (Class I) could occur if significant amounts of oil reached a waterbody.